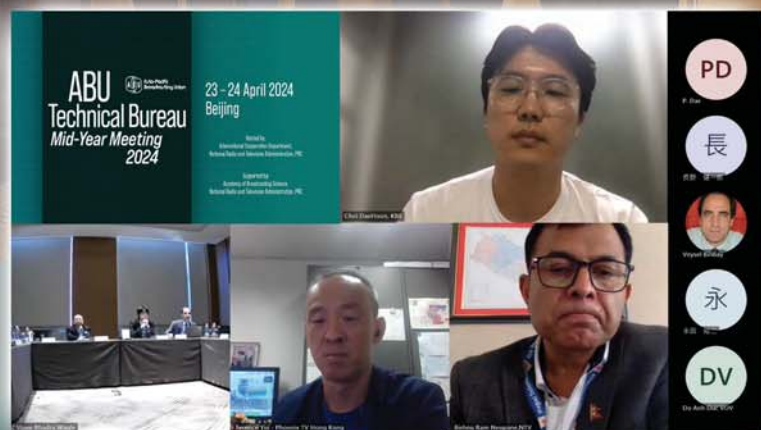


ABU TECHNICAL BUREAU MID-YEAR MEETING 2024



ALSO INSIDE:

Analysis of the impact of WRC-23 outcomes on broadcasting service in the Asia-Pacific area

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Cover: ABU Technical Bureau Mid-year Meeting 2024

from The Editor

Welcome to the 298th edition of ABU Technical Review, your trusted source for insights into the broadcasting industry in the Asia-Pacific region. This issue features a rich array of articles, event highlights, and updates, showcasing the latest trends and innovations in our field.

We start with an in-depth analysis by Dr. Li Leilei on the impact of the WRC-23 outcomes on broadcasting services, providing a thorough examination of regulatory and technological shifts that are poised to shape our industry's future.

Our coverage of the 30th China Content Broadcasting Network (CCBN 2024) Exhibition in Beijing highlights the ground-breaking technologies and content solutions presented. We also detail the ABU Technical Bureau's mid-year meeting and the joint seminar with NRTA, which was in conjunction with the CCBN celebrations.

In the technical section, Wei Na from NRTA delves into the complexities of 6DoF VR video content production, distribution, and real-time interaction across platforms. Additionally, Amir Reza Saadatmand Tale and Dr. Mohieddin Moradi from IRIB discuss advanced techniques for contrast enhancement of low-light images using dynamic range modifications.

This edition also includes a report from BroadcastAsia 2024, regional updates from the ABU, and the latest in digital broadcasting and equipment trends. Our "Personalities & Posts" section highlights influential figures within our community, while the "Calendar of Events" keeps you informed about upcoming industry gatherings and workshops.

Our goal with each edition is to provide valuable knowledge and foster a collaborative spirit among broadcasters. We hope this issue inspires new ideas and furthers your understanding of the dynamic changes within our industry.

Thank you for your continued readership and engagement. We look forward to sharing more with you in the future.

Warmest regards,
Dr Veyssel Binbay
veysel@abu.org.my

The Asia-Pacific Broadcasting Union (ABU) is a professional union of broadcasting organisations in the Asia-Pacific area which aims to co-ordinate and promote the development of radio, television and allied services in the region. It is non-governmental, non-political and non-commercial.

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ANALYSIS OF THE IMPACT OF WRC-23 OUTCOMES ON BROADCASTING SERVICE IN THE ASIA-PACIFIC AREA

ACADEMY OF BROADCASTING PLANNING, NRTA

SUMMARY:

This paper delineates the outcomes of the recent World Radiocommunication Conference 2023 (WRC-23). It provides a clear understanding of the global regulatory landscape and its potential impact on the broadcasting service in the Asia-Pacific area.

INTRODUCTION

The recent World Radiocommunication Conference (WRC-23) successfully concluded in December 2023 and achieved impressive outcomes in new terrestrial and space services. These results will greatly improve the way we communicate on land, in the air and at sea for everyone served by the world's radio frequency spectrum, and will have long-term social, economic and environmental impacts on all nations for generations to come.

During the WRC-23 meeting, Member State delegates of the International Telecommunication Union (ITU) undertook a comprehensive review of Radio Regulations to ensure that the international framework for the management of the radio frequency spectrum and associated orbital resources are kept up to date. At the same time, the conference found a solution to a wide range of technological challenges, supporting spectrum sharing and on-going innovation to enable global harmonisation over the next four years and beyond. This article is dedicated to an analysis of the impact of WRC-23 conference outcomes on broadcasting operations in the Asia-Pacific region.

WRC-23 1.2 AGENDA ITEM

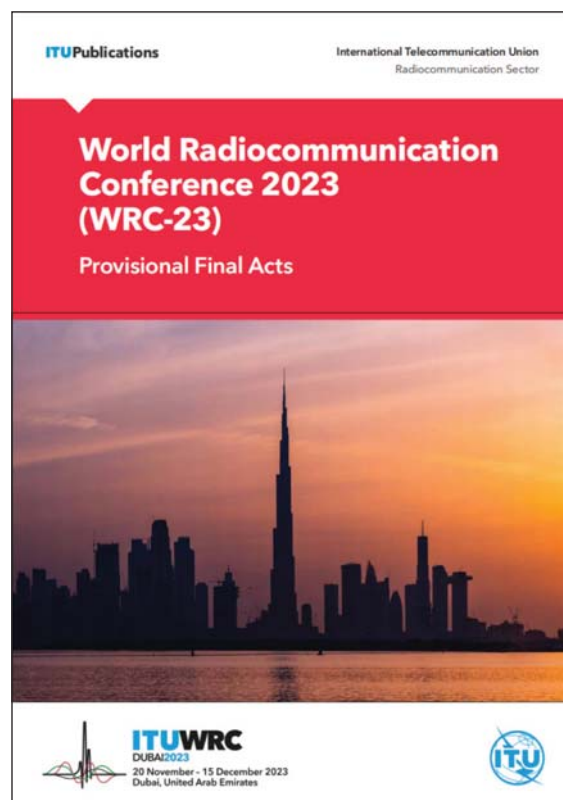
This item is to identify the frequency bands 3300-3400MHz (Region 1¹ & 2²), 3600-3800MHz (Region 2), 6425-7025MHz (Region 1), 7025-7125MHz (global) and 10.0-10.5GHz (Region) for International Mobile

Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis. The Radio Regulations do not clearly allocate the band 3700-4200MHz to broadcasting-satellite services on a primary basis in the Asia-Pacific area (Region 3³). In practice, many countries in Region 3 transmit radio and television programs through fixed satellite services (space-to-Earth). Therefore, the identification of IMT on the band 3600-3800MHz in Region 2 will impact the satellite transmission of radio and television programs in the Asia-Pacific area.

In accordance with the WRC-23, a new footnote No. 5.36A12 has been established which stipulates that "in the Bahamas, Belize, Brazil, Canada, Colombia, Costa Rica, United States, Guatemala, the French overseas departments and communities in Region 2, Greenland, the overseas countries and territories within the Kingdom of the Netherlands in Region 2, Paraguay, Peru, Trinidad and Tobago and Uruguay, the frequency band 3700-3800MHz is identified for use by any of these administrations wishing to implement International Mobile Telecommunications (IMT)." In addition, No.

5.434 has been updated to include the identification of IMT in Region 2 within the band 3600-3700MHz. Meanwhile, Nos. 5.434 and 5.36A12 footnotes clearly state that the IMT logo does not hinder other businesses that have been division and is not a priority. The implementation of IMT is required to ensure the protection of the fixed-satellite service (space-to-Earth).

Administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to ensure the



protection of the fixed-satellite service (space-to-Earth). This condition ensures the use of satellite transmission of radio and television programs in the Asia-Pacific area and to avoid potential frequency interference. Since Regions 2 and 3 do not have direct terrestrial borders, the fixed-satellite service (space-to-Earth) can limit coverage to avoid interference. Therefore, WRC-23's decision on this item will have minimal impact on the transmission of radio and television programs in the Asia-Pacific area.

WRC-23 1.3 AGENDA ITEM

This item is to consider the primary allocation of the frequency band 3600-3800MHz to the mobile service in Region 1 and take appropriate regulatory action. This item is similar to the item 1.2. The Radio Regulations do not clearly allocate the band 3700-4200MHz to broadcasting-satellite services in the Asia-Pacific area (Region 3). In practice, many countries in Region 3 transmit radio and television programs through the fixed satellite service (space-to-Earth). Therefore, the primary allocation of the frequency band 3600-3800MHz to the mobile service in Region 1 will impact the satellite transmission of radio and television programs in the Asia-Pacific area.

The WRC-23 reached a consensus on this item and subsequently introduced four new footnotes, Nos. 5.A13A, 5.A13B, 5.A13C and 5.A13D. No. 5.A13A provides technical constraints and coordination procedures for the use of mobile services (except aeronautical mobile) in the band 3600-3800MHz. No. 5.A13B specifies that the band 3600-3800MHz is allocated to mobile service secondary in some countries. No. 5.A13C stipulates that in some countries the band 3600-3700MHz is identified for IMT. No. 5.A13D mandates that in some countries the band 3600-3800MHz is identified for IMT, with the stipulation that this identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. It is further clarified that the conditions of No. 5.A13A shall apply.

In No. 5.A13A, the technical restrictions are specified that for the protection of stations in the fixed and fixed-satellite services, it shall ensure that the pfd produced at 3 m above ground does not exceed $-154.5 \text{ dB (W/(m}^2 \bullet 4 \text{ kHz))}$ for more than 20% of the time at the

border of the territory of any other administration. In addition, stations in the mobile service operating in the frequency band 3600-3800MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations. Although Region 1 has extensive land borders with Region 3 countries, IMT implementation must strictly comply with prescribed technical restrictions, thus ensuring the transmission of radio and television programmes in Region 3. However, it must be noted that as more countries allocate this frequency band to IMT, the transmission of radio and television programs through fixed-satellite service (space-to-Earth) will face increasing restrictions.

WRC-23 1.4 AGENDA ITEM

This item is to consider the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level. The candidate band 694-960 MHz is related to the band 470-702MHz used by digital terrestrial television in the Asia-Pacific area.

WRC-23 takes a decision on this item, adding two new footnotes Nos. 5.14A and 5.14B. In No. 5.14A, the band 698-960MHz, or portions thereof, in Region 2, and the band 694-960MHz, or portions thereof, in Region 1, are identified for use by HIBS. In No. 5.14B, the frequency band 698-960MHz, or portions thereof, in Australia, Maldives, Micronesia, Papua New Guinea, Tonga and Vanuatu, the frequency bands 703-733MHz, 758-788MHz, 890-915MHz and 935-960MHz, or portions thereof, in China, India, Indonesia, Japan, Korea (Rep. of), Malaysia, the Philippines and Thailand are identified for use by HIBS. Furthermore, Nos. 5.14A and 5.14B clearly state that this identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. In addition, HIBS shall not claim protection from existing primary services.

Given that the power of digital terrestrial TV transmitters is far greater than that of HIBS transmitters, HIBS will not be deployed with digital terrestrial TV in the same frequency band, thus ensuring the use of the existing digital terrestrial TV in the Asia-Pacific area.

WRC-23 1.5 AGENDA ITEM

This item is a new primary allocation of

the band 470-694MHz to mobile service in Region 1, relating to the band 470-702MHz used by digital terrestrial TV in the Asia-Pacific area.

The outcome of the item is to add 3 new footnotes Nos. 5.15A, 5.15B and 5.15C, allocating the band 470-694MHz on a secondary basis to the mobile service in 44 European countries and the band 614-694MHz in eight African countries, while allocating the band 614-694MHz on a secondary basis to mobile service in 11 countries of the Middle East with IMT identification. Modify No. 5.294 to allocate the band 470-582MHz to the fixed service on a secondary basis in Palestinian. Revise No. 5.296 to allocate the band 470-694MHz on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Modify Resolution 235 to consider upgrading the mobile service on a primary basis in the band 614-694MHz at the WRC-31 meeting (referring to 44 European countries, see No.5.15A).

In 11 Middle Eastern countries, the band 614-694MHz frequency is allocated on a primary basis to the mobile service with IMT identification. However, extremely strict coordination conditions are given. Stations in the mobile service shall not create a field strength for more than 1% of the time at the highest of the clutter height or 10 m above ground level at the border of the territory of any other administration that exceeds the field strength value as calculated using §4.1.3.2 of Annex 2 to the GE06 Agreement with regard to allowance for multiple interference, Table AP1.10 and the methodology given in the GE06 Agreement. Stations in the mobile service of the countries listed in this footnote shall not cause harmful interference to or claim protection from the existing and future broadcasting stations of the neighbouring countries operating in accordance with the GE06 Plan. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations and shall in no way adversely affect the development of the existing and future broadcasting service in accordance with the GE06 Agreement. For countries party to the GE06 Agreement, the use of stations in the mobile service is also subject to the successful application of the procedures of that Agreement. This allocation does not establish priority in

the Radio Regulations and shall allow the implementation and development of the broadcasting service in accordance with the GE06 Agreement. These 11 Middle Eastern countries are not adjacent to countries in the Asia-Pacific area except Iran, and Iran is a party to the GE06 Agreement, so terrestrial digital TV in the Asia-Pacific area will not be affected.

At present, 30 countries around the world have allocated the band 600 MHz to IMT through footnotes. In addition, pursuant to Resolution 235, WRC-31 will consider the primary allocation of the band 614-694 MHz to the mobile service with IMT identification in Region 1. This trend suggests that IMT's continued expansion into the band 600 MHz could adversely affect terrestrial digital TV in the Asia-Pacific area. Therefore, we must closely monitor these developments and take appropriate action to address potential challenges.

WRC-23 1.19 AGENDA ITEM

This item is to consider the allocation of the band 17.3-17.7GHz to the fixed-satellite service (space-to-Earth) in Region 2. Since the band 17.3-17.7GHz is allocated to the fixed-satellite service (Earth-to-space) in Region 3, the band 17.3-18.1GHz is involved for the feeder link of satellite broadcasting service.

WRC-23 decided on this item, adding new footnotes Nos. 5.A119 and 5.C119 to allocate the band 17.3-17.7GHz to the fixed-satellite service (space-to-Earth) on a primary basis with the coordination procedures and technical restrictions in Region 2. In addition to the need to comply with the coordination criteria in Annex 4 of Article 7 of Appendix 30A, under assumed free-space propagation conditions, the power flux-density of an assignment in the fixed-satellite service (space to-Earth) of a geostationary-satellite network in the frequency band 17.3-17.7GHz in Region 2 shall not exceed the value of $-98 \text{ dB(W/(m}^2 \bullet 27 \text{ MHz))}$ at points in the geostationary-satellite orbit with geocentric orbital separation angles between 152.6° and 162.6° .

The above regulations put forward strict coordination procedures and technical limits for the fixed-satellite service (space-to-Earth) and ensure the use of feeder link for broadcasting service in the Asia-Pacific area.

WRC-27 AGENDA ITEMS

The following six WRC-27 agenda items relate to the broadcasting service in the Asia-Pacific area.

WRC-27 1.4 agenda item is to consider a possible new primary allocation to the fixed-satellite service (space-to-Earth) in the frequency band 17.3-17.7 GHz and a possible new primary allocation to the broadcasting-satellite service (space-to-Earth) in the frequency band 17.3-17.8 GHz in Region 3, while ensuring the protection of existing primary allocations in the same and adjacent frequency bands, and to consider equivalent power flux-density limits to be applied in Regions 1 and 3 to non-geostationary-satellite systems in the fixed-satellite service (space-to-Earth) in the frequency band 17.3 17.7 GHz, in accordance with Resolution COM6/24 (WRC 23). This item is related to a possible new primary allocation of satellite broadcasting service(space-to-Earth).

WRC-27 1.6 agenda item is to consider technical and regulatory measures for fixed-satellite service satellite networks/ systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) for equitable access to these frequency bands, in accordance with Resolution 131 (WRC-23). According to the Radio Regulations, the band 40.5-42.5 GHz band is allocated to the broadcasting and broadcasting-satellite services, but there is no actual system used in this band, so there is no need to track this issue.

WRC-27 1.9 agenda item is to consider appropriate regulatory actions to update Appendix 26 to the Radio Regulations in support of aeronautical mobile (OR) high frequency modernisation, in accordance with Resolution 411 (WRC-23). The item is related to the broadcasting service in the band 3900-3950kHz in Region 3 and the band 4750-4850kHz in Region 1.

WRC-27 1.10 agenda item is to consider developing power flux-density and equivalent isotropically radiated power limits for inclusion in Article 21 of the Radio Regulations for the fixed-satellite, mobile-satellite and broadcasting-satellite services to protect the fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz, in accordance with Resolution 775 (Rev.WRC-23). According to the Radio Regulations, the band 74-76GHz

is allocated to the broadcasting and broadcasting-satellite services, but there is no practical system in use in this band, so there is no need to focus on this issue.

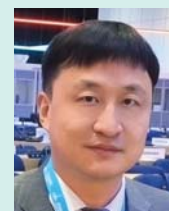
WRC-27 1.13 agenda item is to consider studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage, in accordance with Resolution 253 (WRC-23). The item is related to the 694/698MHz to 2.7GHz band, given that some countries in the Asia-Pacific area have used the band 694-702MHz for digital terrestrial TV.

WRC-27 1.17 agenda item is to consider regulatory provisions for receive-only space weather sensors and their protection in the Radio Regulations, considering the results of ITU Radiocommunication Sector studies, in accordance with Resolution 682 (WRC-23). The item is related to the digital terrestrial TV in the Asia-Pacific area.

REFERENCES:

- ¹ According to ITU, Region 1 refers to Europe, Africa, the Middle East and the CIS area.
- ² According to ITU, Region 2 refers to the American area.
- ³ According to ITU, Region 3 refers to the Asia-Pacific area.

AUTHOR:



Prof. Li Leilei's academic journey culminated in a PhD from Loughborough University in the United Kingdom.

He is currently the Deputy Director of the Standard & Information Department at NRTA's Academy of Broadcasting Planning, focusing on areas such as terrestrial digital television frequency allocation, wireless broadcasting technology, and standardisation strategies. Since 2016, he has chaired the Spectrum Group within ABU's Technical Bureau. As of March 2023, he holds the prestigious role of Vice-Chair for ITU-R SG6. ■

THIRD GENERATION AVS VIDEO CODING STANDARD (AVS3): FEATURES AND APPLICATIONS

(LIVE WEBINAR, 9 APRIL, BY YUN ZHOU, ACADEMY OF BROADCASTING SCIENCE (ABS), NRTA)

ABUTechnologyWebinar

The Speaker

Third Generation AVS Video Coding Standard (AVS3): Features and Applications

She received the B.S. and M.S. degree from Beijing University of Posts and Telecommunications, Beijing, China, in 2013. She is currently serving as a Senior Engineer at Academy of Broadcasting Science (ABS), National Radio and Television Administration (NRTA). She has dedicated years to advancing the frontiers of technology in broadcasting and television. Her main research interests are related to Ultra-High Definition Television (UHDTV), audio-visual coding, and immersive media technologies. She has got involved in the establishment of broadcasting industry standards such as AVS2 and AVS3 coding standards in China.



Zhou Yun
Senior Engineer,
Academy of
Broadcasting Science,
NRTA-China

On 9 April 2024, the Asia Pacific Broadcasting Union hosted a webinar titled “Third Generation AVS Video Coding Standard (AVS3): Features and Applications”, presented by **Ms Zhou Yun**, Senior Engineer at the Academy of Broadcasting Science, NRTA-China. The session provided an in-depth exploration of AVS3, highlighting its features, applications, and the advancements it brings to video coding technology.

Zhou Yun began by introducing the basic concepts of video coding, also known as video compression. Video coding aims to reduce the amount of video data while maintaining a certain level of quality. This process involves an encoder and a decoder system, collectively known as a codec. The encoder compresses the video data, which is then transmitted or stored, and the decoder reconstructs

the original video data for display.

The discussion moved on to the four main types of redundancies in video coding: spatial, temporal, visual, and statistical. Zhou explained how these redundancies are exploited to achieve compression. For instance, temporal redundancy leverages the similarities between consecutive frames to reduce the bit rate.

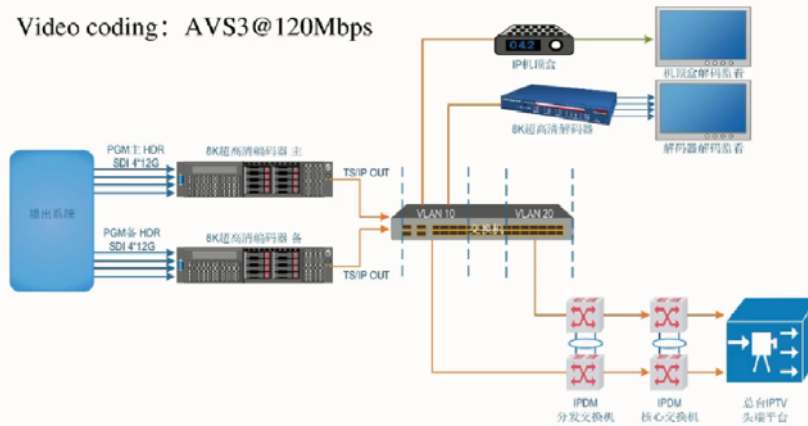
The presentation provided an overview of the evolution of video coding standards, both internationally and within China. International standards such as MPEG and ITU-T's H.264 and H.265 were mentioned alongside China's own AVS standards. Zhou highlighted the continuous efforts of the AVS working group in China, which has developed AVS1, AVS2, and now AVS3 over the past two decades.

Application of AVS3

8K channels launched in China

CCTV 8K

- Began trial broadcasts in February, 2021
- Video Format: 7680×4320/50P/10bit/HLG/BT.2020
- Video coding: AVS3@120Mbps



Zhou Yun detailed the key features of the AVS3 standard, emphasizing its advanced and efficient video coding capabilities. AVS3 achieves significant bit rate savings compared to its predecessors and other international standards. The development process of AVS3 was outlined, including its two-phase approach that resulted in substantial coding gains.

1. **Flexible Partition Mechanism:** AVS3 supports a more flexible block structure, adapting to higher resolution videos like 8K. It uses binary tree and extended coding tree partitions to enhance prediction accuracy.
2. **Improved Prediction and Transform:** The standard introduces new inter and intra-prediction modes, motion vector prediction techniques, and adaptive transform methods to improve compression efficiency.
3. **Enhanced Filtering Techniques:** AVS3 incorporates advanced filtering techniques such as deblocking and sample adaptive offset filters to improve video quality by reducing artifacts.

The webinar included a performance evaluation of AVS3, showing its comparable efficiency to H.266 (VVC) while achieving a 50% bit rate reduction compared to AVS2 and HEVC. Zhou Yun also discussed the practical applications of AVS3 in various domains, such as 8K UHD TV broadcasting, real-time software encoding, and hardware support for consumer electronics.

AVS3 has been adopted as a broadcasting industry standard in China, with applications spanning satellite, cable TV, IPTV, and mobile networks. The webinar



highlighted several successful deployments, including the first 4K live TV channel using AVS2 and the recent launch of 8K UHD TV channels by China Media Group and Beijing Radio Television.

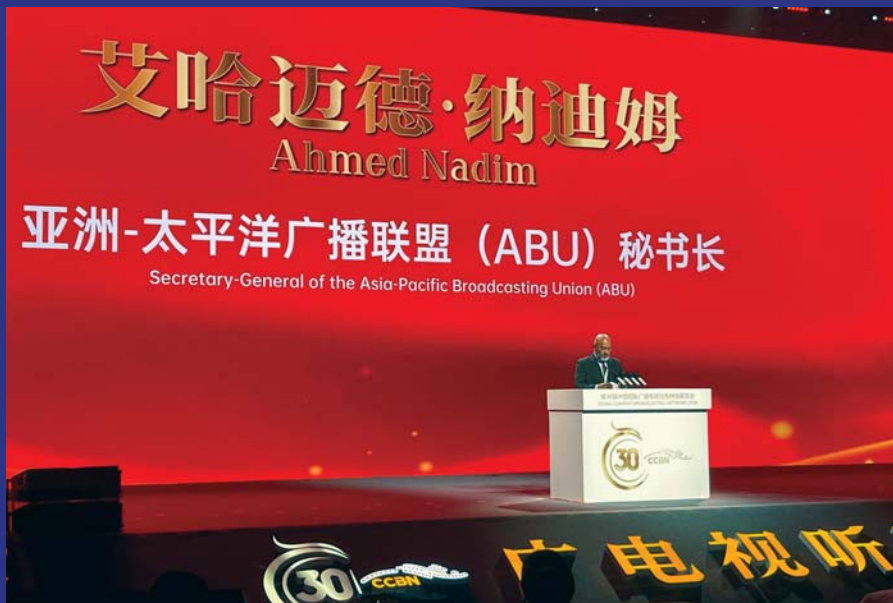
Zhou Yun concluded the webinar by summarizing the significance of AVS3. As the third generation of video coding standards in China, AVS3 offers advanced and efficient video coding solutions, playing a crucial role in the promotion and application of 4K and 8K UHD TV. The standard's ability to achieve substantial bit rate savings while maintaining high video quality positions it as a key technology for the future of broadcasting.

The webinar provided valuable insights into the technological advancements and practical applications of AVS3, showcasing China's leadership in the development of cutting-edge video coding standards. The session was well-received, offering attendees a comprehensive understanding of AVS3's capabilities and its impact on the broadcasting industry. ■



30TH CHINA CONTENT BROADCASTING NETWORK (CCBN 2024) EXHIBITION IN BEIJING, CHINA

23 - 24 APRIL 2024



ABU Secretariats from the Technology & Innovation Department, including members of the ABU Technical Bureau, attended the 30th China Content Broadcasting Network (CCBN 2024) exhibition in Beijing, China. This prestigious event, organised by the Academy of Broadcasting Science (ABS) and the NRTA, took place from April 23-26, 2024, and featured the latest advancements in broadcasting technology.

At the CCBN conference, **Mr Ahmed Nadeem**, the Secretary-General of the Asia-Pacific Broadcasting Union (ABU) delivered a keynote address, highlighting the importance of collaboration and innovation in the broadcasting industry. Celebrating CCBN's 30th anniversary, the Secretary-General extended heartfelt congratulations, emphasising the event's essential role in fostering industry partnerships and collaboration. Addressing esteemed colleagues and professionals, the Secretary-General highlighted the significant impact of television and radio in shaping societies and promoting cultural exchange across the Asia-Pacific region.

The Secretary-General also emphasised ABU's commitment to fostering collaboration and knowledge-sharing through



initiatives such as the Digital Broadcasting Symposium (DBS). This symposium provides a platform for industry leaders to discuss emerging trends and innovations, with a recent focus on the transformative potential of artificial intelligence (AI) in broadcasting operations and content creation.

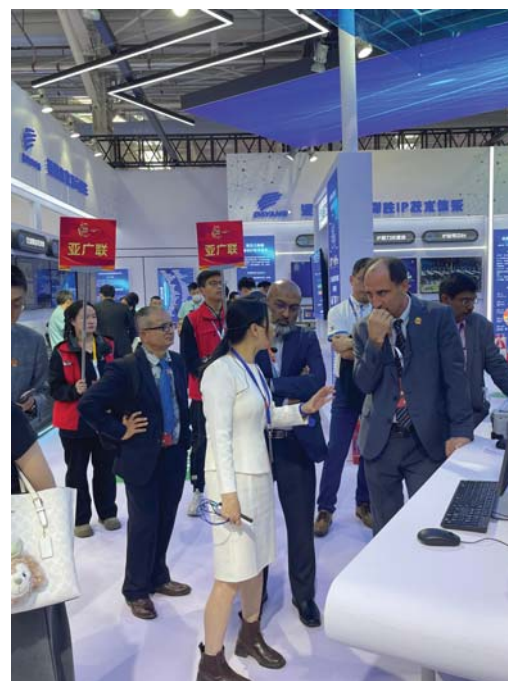
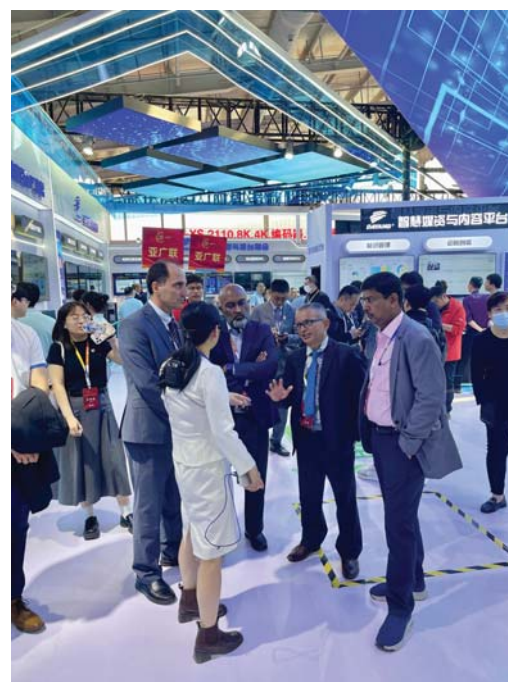
In a nod to environmental sustainability, the Secretary-General stressed the industry's responsibility to reduce its environmental footprint and adopt eco-friendly practices.



The Secretary-General expressed optimism about the future of broadcasting, emphasising the need for member broadcasters to collaborate in addressing challenges and seizing opportunities. Through training programs and collaborative projects, ABU aims to share best practices and enhance broadcasters' capabilities in the digital era.

During the CCBN exhibition, members of the ABU Technology & Innovation Department and the ABU Technical Bureau also got to engage with industry leaders, exploring collaboration and innovation opportunities. They discussed advancements in broadcasting technology, focusing on AI integration and emerging content consumption trends.

Attendees acknowledged the necessity for broadcasters to adapt to these changes and highlighted the importance of knowledge-sharing and cooperation among industry stakeholders. The ABU Technology & Innovation Department and the ABU Technical Bureau members reaffirmed their commitment to fostering collaboration and innovation in the broadcasting sector. By engaging with industry peers and participating in events like CCBN, they aim to contribute significantly to the advancement of the broadcasting industry in the Asia-Pacific region. ■



ABU TECHNICAL BUREAU MID-YEAR MEETING

23-24 APRIL 2024



The ABU Technical Department organised the ABU Technical Bureau Mid-Year Meeting on April 23 to 24 at the Hualuxe Beijing Xinan Hotel in China. Hosted by RTPRC (NRTA), the meeting was conducted in hybrid mode.

The meeting was chaired by Chairman of the ABU Technical Committee **Mr Masashi Kamei** of NHK-Japan, and joined by Vice-Chairman, **Mr Sheng Zhifan** of RTPRC (NRTA) – China. The in-person attendees included representatives from NHK–Japan, PB-India, Mediacorp-Singapore, and IRIB-Iran. Remote participants joined from VOV Vietnam, RTM Malaysia, NTV Nepal, PB India, KBS Korea, and Phoenix Hong Kong, China.

During his opening remarks, ABU Secretary-General **Mr Ahmed**

Nadeem provided an overview of the comprehensive three-year plans crafted for the technical bureau, focusing on initiatives aimed at enhancing members' activities within the organisation. He also elaborated on the broader strategic plans for ABU, emphasising the streamlining of the General Assembly for improved efficiency and effectiveness.

The meeting commenced with the introduction of the new Technical Bureau members, followed by updates on various projects from their respective organisations. Followed by updates from all members on the current situation, this information sharing exercise proved beneficial to members, allowing them to learn from experiences by others and appreciate the situation of other members. The bureau was

presented with the activity report led by **Dr Veyssel Binbay**, Director of ABU Technology. Amongst the items presented was a review of TB tasks and actions, which included updates on different activities, one of which was the DBS2024. The 4-day symposium attracted about 1000 attendees among 300 organisations from 50 countries. DBS2024 had received an incredible amount of support from participants, industry partners, and sponsors who were interested in the event.

The discussion about DBS continued emphasising on the strategies to enhance involvement and input from TB members. Dr Veyssel Binbay provided insights into ABU's initiatives to establish a special session tailored for TB members at the upcoming DBS event. Additionally, various approaches



for addressing vacant TB seats were explored during the discussion.

During the meeting, a significant topic of discussion revolved around a questionnaire that had been provided by the Chairman. This questionnaire was circulated prior to the bureau meeting, aimed to gather insights on the practices of TV and radio broadcasting within each respective organisation. It served as a valuable platform for sharing experiences and engaging in discussions regarding the variations in organisational practices.

Reports on Study Topic Areas were presented by designated chairpersons: **Mr P Das** from PB-India on Training & Services, **Mr Yuji Nagata** from NHK-Japan on Distribution, and **Dr Li Leilei** from RTPRC (NRTA) – China on Spectrum, though Dr. Li was not in attendance.

Finally, the members reviewed and discussed the schedule for the upcoming annual Technical Bureau and Technical Committee meetings. These important meetings are scheduled to take place during the General Assembly, which is set to be held in

the vibrant city of Istanbul, Türkiye, in the month of October. The meeting concluded with the Director of ABU Technology expressing gratitude to the hosts and attendees for their valuable contributions and participation. ■



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ABU AND NRTA SEMINAR AT 30TH CCBN CELEBRATION



The ABU seminar, titled “Trendsetters in the Media Industry: Next-Gen AV Codecs, AI Tools, and Virtual Production”, was a dynamic gathering of industry pioneers held on Thursday, 25 April, at the Buffer Room Multifunction Hall in the Shougang Exhibition and Convention Center, Beijing. Hosted by the National Radio and Television Administration (NRTA) and the Asia-Pacific Broadcasting Union (ABU) Technical Bureau, this event was part of the 30th anniversary celebrations of the China Content Broadcasting Network Exhibition 2024 (CCBN).

The opening ceremony began with remarks from **Ms Yan Ni**, Deputy Director of the International Cooperation Department of the NRTA, and was moderated by **Mr Sheng Zhifan**, Vice Chairman of the ABU Technical Committee.

The seminar featured six engaging sessions, each highlighting different aspects of innovation in the media

industry. **Dr Peter Siebert**, Vice President of BTS Conferences at IEEE BTS, initiated the event with a captivating presentation on the “Commercial and Technical Aspects of Next Generation Video Coding for Broadcast and Broadband”. Following him, **Mr Toni Fiedler**, Head of China and SEA at Fraunhofer IIS, presented on the topic “AI-Supported Digital Audio Processing Quality Improvement Possibilities for Legacy Content”.

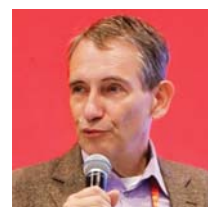
Mr Kenichiro Nagano, Technical Manager at NHK World, captivated attendees with insights on “Deploying Content to The Metaverse”, discussing how this frontier is reshaping our digital experiences. **Dr Mohieddin Moradi**, Director General of IRIB R&D, continued with a presentation on “Virtual Production Studio Design Based on LED Volume”. **Ms Zhou Yun**, Senior Engineer at the Academy of Broadcasting Science, presented



Ms Yan Ni



Mr Sheng Zhifan



Dr Peter Siebert



Mr Toni Fiedler



Mr Kenichiro Nagano



Dr Mohieddin Moradi



Ms Zhou Yun



Mr Kenneth Lawrence

Credits to the Academy of Broadcasting Science, National Radio and Television Administration.

the “AVS3 Coding Standard: Features and Applications”.

The final session, led by **Mr Kenneth Lawrence**, Chairman of the CM-SEG Workgroup, focused on “DVB-I and Europe”.

The seminar concluded with a lively Q&A session, marking the successful end of the event. With nearly 100 participants from Afghanistan, Antigua and Barbuda, Armenia, Burundi, China, Cuba, Fiji, Grenada, Iraq, Nigeria, Trinidad and Tobago, as well as Uzbekistan, the seminar was a notable success, reflecting the global interest and engagement of the latest media industry trends. ■



ABU TECHNICAL BUREAU VISITS BEIJING RADIO AND TELEVISION STATION (BRTV)

On April 26th, members of the ABU Technical Bureau, along with the ABU Secretariat, embarked on a visit to the Beijing Radio and Television Station (BRTV). This visit provided an opportunity for the team to familiarise themselves with the latest advancements in broadcasting technology showcased by the public broadcaster.

As they stepped into the studio featuring state-of-the-art 4K and 8K television displays, the delegation was impressed by the stunning imagery and flawless quality. This immersive experience offered valuable insights into the vast potential of ultra-high-definition broadcasting.

During the excursion, attendees were treated to a live demonstration of continuous broadcasting, highlighting the station's ability to provide round-the-clock programming across various channels. Engaging in discussions with BRTV's technicians and engineers, the delegation explored the intricacies, challenges, and opportunities presented by 4K and 8K television. These conversations served to foster collaboration and innovation within the ABU community.

The delegation reaffirmed ABU's dedication to exchanging insights from BRTV's advancements and driving technological progress within the broadcasting sector. ■







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6DoF VR VIDEO CONTENT PRODUCTION, DISTRIBUTION AND MULTI-PLATFORM REAL-TIME INTERACTION

ACADEMY OF BROADCASTING SCIENCE, NRTA

ABSTRACT:

This project provides a full-chain solution for 6DoF VR multi-modal video content production, distribution and experience, which has achieved the effects of significantly reducing production complexity and production time, reducing the amount of distributed data, cross-platform terminal access, real-time interaction in multi-person virtual space, and strong immersion interaction.

KEYWORDS:

6DoF (Degree of freedom), Virtual Reality, Content Production, Multi-platform, Real-time Interaction

1. INTRODUCTION

6DoF VR video content generally has problems such as high production difficulty, low scene richness, large amount of data, immature interactive patten, and limited large-scale application. This project has developed 6DoF VR video content production and distribution technology based on multi-modal data intelligent conversion, immersive interaction technology based on fixation and distance guidance, real-time rendering technology of digital image animation based on reverse dynamics and multi-platform VR video interactive technology. The 6DoF VR multi-modal video content production, distribution and multi-platform real-time interaction system was built to solve the above problems.

On the content production end, in the past, it was necessary to use 3D engines such as Unity for individual scene design and production, which was highly professional and difficult. This system can reduce the dimension and template processing of complex 3D scene content production, reduce the production difficulty and time, and reduce the amount of data required for transmission, also can carry out intelligent conversion of multi-modal material content. It improves the richness of scene content. At the content experience end, through multi-modal content fusion and multi-sensory

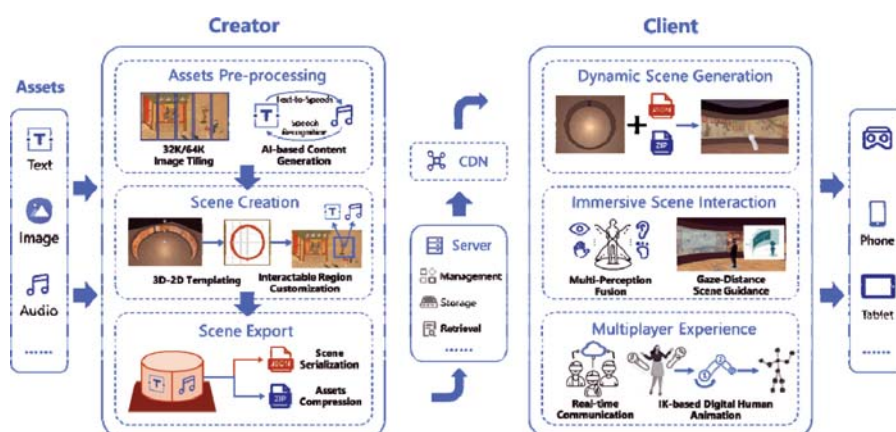


Figure 1 : End-to-end system solution diagram

guided interaction, users' cognition of the virtual environment is enhanced. Local motion capture, global physical inference and other technologies are used to generate and render accurate digital images and actions in real time, combined with multi-user, low-latency interaction technologies enriched the interactive patten and enhance the natural and immersive sense of interaction. The system is compatible with OpenXR standard, suitable for multiple platforms, also can support large-scale dissemination and application of 6DoF VR video content.

2. ARCHITECTURE SOLUTION AND KEY TECHNOLOGIES

2.1 END-TO-END SOLUTION

This project has developed a 6DoF VR

multi-modal video content production, distribution, and multi-platform real-time interaction system, which is divided into three parts: content production, content data distribution and content experience/interaction. The end-to-end system solution is shown in **Figure 1**.

2.2 CONTENT PRODUCTION END

The content production end is responsible for organising, converting, positioning and editing the imported scene materials, generating 6DoF VR video scene description files, packaging the resources, and uniformly uploading them to the content data distribution end. The content production end screenshot is shown in **Figure 2**.



Figure 2 : Screenshot of the content production end

The key technologies of the content production end are as follows:

- The typical three-dimensional scenes in the actual application requirements are templated and presented in two-dimensional form, which reduces the complexity of scene design, understanding and production;
- Images, texts, audio and other multi-modal materials can import VR image support 64K and above ultra-high resolution. By dividing the original image into several block images with lower resolution, it can avoid decoding and rendering failure, maintain high fidelity and high definition;
- Can set user interaction points and place material content at different locations in a scene, and the system can automatically generate multi-sensory guided interaction areas in three-dimensional space;
- Though AI technology, it can convert text to audio, audio to text, to achieve multi-modal content conversion, so that the scene content can be selected by the user in the most appropriate mode of presentation;
- When the content is completed, the content location and interactive information can be text serialised, the scene description file is generated, and only the original material and

part of the generated content are compressed and packaged, avoiding the direct transmission of three-dimensional scene and object data, which greatly reduces the amount of data required for distribution.

2.3 CONTENT DATA DISTRIBUTION END

The content distributor receives the produced scene content file through the network server, and with the optional content distribution network (CDN), provides the access, retrieval, addition, deletion and other capabilities of the scene description file and resource file, to achieve the rapid distribution of the produced content in many places.

2.4 CONTENT EXPERIENCE AND INTERACTION END

After the content experience end obtains the scene description file and resource file from the content distribution end, it generates the 6DoF VR video scene conforming to the description in real time, dynamically and asynchronously. Users can enter the scene through different terminals, experience the scene in six degrees of freedom, and communicate and interact with other users in the same scene in real time with low delay. The screenshot of museum scene shown in Figure 3.



Figure 3 : Screenshot of the museum scene

The key technologies of the content experience end are as follows:

- Users can browse, retrieve, and access all the scenes stored on the server. After selecting a scene, the system automatically downloads and decompresses the corresponding resource file to load the scene template (shown in Figure 4-1);
- The experiential software can asynchronously and dynamically fill the material, set the location and various properties, add interactive areas and behaviors, and then generate 6DoF VR video scenes in real time (shown in Figure 4-2);
- The sensor of VR headset display and other devices can capture the user's gaze angle and spatial position information in real time, and then dynamically match and display/hide the interaction area inside/outside the current field of view, guide the user's scene, and improve the concentration of its experience;
- The experience end supports multi-sensory integration of multi-modal content, and enhances the user's immersion experience and the awareness of scene information through ultra-high-definition image rendering and spatial audio playback;
- Through real-time network data exchange, support multiple users to experience the same scene at the same time, and through voice and other low-latency interaction;
- Use the sensor of VR headset display and other devices to obtain the key point pose of the user's part bone, deduce the parent bone pose based on reverse dynamics, and then adjust the whole bone chain data to generate natural digital image action animation (shown in Figure 5);
- Compatible with the OpenXR standard, generate content experience terminals running on different devices and system platforms, adaptive adjustment of interaction interface, interaction mode, operation parameters, etc., to achieve a multi-user, cross-platform real-time interactive experience of 6DoF VR video content, so that the wide range of 6DoF VR video content promotion and application is no longer limited to VR hardware equipment.



Figure 4-1 : Users choose the scene



Figure 4-2 : Users choose the viewing area

3. HIGH-LIGHT FEATURES (DATA BASED ON ACTUAL TESTS)

- a) The equivalent video resolution is more than 64000×3840, and the spatial audio effect is equivalent to 32 channels;
- b) The 6DoF VR video frame rate reaches 120fps, the number of scene vertices exceeds 11000, and the number of triangular pieces exceeds 14500;
- c) Compared with the ordinary 6DoF VR system, the user's memory ability, understanding ability and immersion score of the 6DoF scene are improved by 12%, 27% and 13% on average;
- d) The server is configured with 16GB memory, which can support 300 users online in the same scene at the same time. The delay of multi-user voice interaction is less than 200ms;
- e) The system supports real-time calculation of 144 skeletal pose animations with a frame rate of 75fps;
- f) Terminal type supports computer, mobile phone, tablet, VR headset and so on.

4. APPLICATION SCENARIOS

In the 6DoF VR video content production, the complex and time-consuming 3D scene production is converted to 2D graphic design and editing, which greatly reduces the difficulty of 6DoF video content production and saves production time and cost. At the same time, the generated scene content data can be described by text serialisation, avoiding the direct transmission of 3D scene data, and also reduces the amount of data required for distribution.

In terms of 6DoF VR video content experience, it supports multi-modal data multi-sensory experience, multi-user real-time experience, and low-latency interaction, and supports cross-platform experience of VR headsets, mobile phones, tablets, computers, and other devices.



Figure 5 : Generate natural digital image motion based on reverse dynamics



Figure 6 : Application case of Peking University Golden Autumn Education Group

The system can be applied to a variety of patters such as VR+ cultural travel, VR+ education, VR+ training, VR+ entertainment and so on.

At present, the system has been applied to some offline teaching points of Peking University Golden Autumn Education Group (shown in **Figure 6**), Migu Virtual Museum project, etc., and is promoting the application with Henan Museum, Bohua Ultra-HD Innovation Center, Shanghai Jing Qing Hui Vision Technology Co., LTD.

AUTHOR



Wei Na holds a master's degree in electronic and communication engineering, and is engaged in high-tech video, virtual reality, TV production broadcast, and other fields of technology research and application work. As the project leader, she completed several SARFT scientific research projects and took the lead in compiling several broadcast and television industry virtual reality technology standards. ■

CONTRAST ENHANCEMENT OF LOW-LIGHT IMAGES BASED ON DYNAMIC RANGE CHANGES

ABSTRACT:

There are several factors that can lead to the degradation of image quality during imaging - one of these factors is light. For example, objects are often not visible in low-light conditions. There are many methods to solve problems called contrast enhancements that can improve the visibility of the objects, but for these methods, not much attention is paid to the naturalness of colour images. In this paper, an image enhancement method inspired by the Hybrid Log Gamma system is proposed. In this dynamic-based approach, the light values of the input image are first transferred to the high dynamic range ecosystem and increased to an equilibrium threshold by a bilateral filter, and then, based on tone mapping methods, an enhanced output is obtained. To measure the effectiveness of the proposed method, it has been compared objectively and subjectively with several existing methods in this field. The results show that the proposed method preserves the artistic goals, presents a natural image, and shows the details to the desired extent.

KEYWORDS:

Image enhancement, contrast enhancement, low light image.

1. INTRODUCTION

There are some uncontrollable factors that can lead to the degradation of image during imaging and photography. For example, enough light is required to obtain images of good quality, and it is difficult to detect scene objects in images captured in insufficient light conditions. In general, the light reflected from the object's surface may be weak in low-light conditions, such as indoors, at night or on cloudy days. As a result, images captured in this environment have features like low contrast, a narrow colour range, low brightness and colour distortion. The use of open shutter techniques is one method used for image capture in low-light conditions. It is very important to hold the camera without moving in this situation, and with intense hand and camera movements, this approach does not provide much enhancement. The use of a flashlight is another approach, but it should be noted that the camera flashlight disturbs the ambient light balance and disturbs the eyes of those present on the scene. Another approach is to change exposure parameters, such as increased ISO sensitivity and lower shutter velocity, which can cause noise and degradation on images.

Improvements in software algorithms and the use of digital image processing have often been taken into consideration as an alternative method, especially due to their versatility. The main goal of low-light image enhancement is to improve the local and global contrast of the image, improve its visual effect, and modify the image into a form that is more appropriate for visual perception or computer processing. Such an enhancement can make the images more compatible with the mental perception of individuals, and it also allows computer vision equipment to easily analyse and process them. Although promising research has been done on this topic, the technology continues to evolve because, in

some respects, current algorithms are often more efficient than others [1, 2]. In this article, inspired by the Hybrid Log Gamma (HLG) system, we propose an approach based on dynamic range changes. Since the dynamic range is equal to the contrast ratio logarithm in base 2, any changes in it can change the contrast. The rest of the article is organised as follows: Initially, some past and related works are investigated in the second section. Then, the proposed approach and associated results are introduced and discussed in sections 3 and 4, respectively. Finally, a conclusion is presented in section 5.

2. RELATED WORK

In recent years, many enhancement algorithms from various aspects have been suggested for images taken in low-light conditions [1–15]. For example, histogram equalisation (HE) techniques [3–5] use the Cumulative Distribution Function (CDF) to similarly change the pixel values of an image and to provide a probability density function proportional to the uniform distribution at all possible gray levels. While this can expose hidden information in dark regions and increase the visual quality of the input image efficiently, HEs may also cause the generation of noise and a loss of colour fidelity, resulting in distortion of the image.

Another group of methods, focused on the Retinex theory, have been suggested [6–8]. In terms of colour image enhancement, these approaches have substantial benefits. However, to estimate the illumination, these algorithms use the Gaussian convolution pattern and do not have the capability to maintain the edges. As a result, in certain areas with sharp boundaries, they may contribute to halo phenomena or make the whole image very bright.

Another technique is methods of image fusion [10–12] that can produce good results by generating and integrating various exposures of input images. However, they need two or more images of a scene, so it is not easy to achieve image improvement within a short period of time, as it is necessary for monitoring conditions in real time.

In recent years, machine learning-based methods [13–15] have been offered for image enhancements. Although these methods can have the desired performance, they require a large amount of data, and increasing the complexity of a model causes the time complexity of the related algorithms to increase dramatically [1].

In general, in all these methods, the increase in image contrast is based on one or more secondary objectives. For example, some methods aim at the naturalness of the output image, because the increase in contrast in low-light areas is sometimes so great that these areas become blurred and faded. Although these methods try to restore the colour of the original scene, they usually do not pay attention to the artistic goals of the original image. Another group focused on revealing more detail, but too much contrast can lead to the appearance of artifacts in the image that were not previously visible. Although some approaches have placed the confrontation with these visual artifacts on their agenda, they have ignored the issue of colour accuracy. The main purpose of this paper is to provide a contrast enhancement method that can reveal details as much as possible without the appearance of artifacts and maintain the naturalness of the output image as much as possible. The proposed method is described in the next section.

3. METHODOLOGY

Contrast enhancement algorithms either operate on colour channels or apply processes to the luminance channel. Our purpose is to keep the image natural after enhancement, in such a way that the colour concentration is maintained as much as possible and the contrast of low-light areas does not amplify too much, because in cases of excessive amplification, the artifacts will be observed in the output image, which will make the output image more unpleasant in comparison with

the input image. In fact, our main purpose is to enhance the contrast of the image so that the result is visually desirable. In this regard, our method is based on dynamic range change in High Dynamic Range (HDR) and Low Dynamic Range (LDR) ecosystems, and its general framework is illustrated in **Figure 1**.

As can be seen, our approach consists of two main parts: 1. Increasing the dynamic range of the input image to an equilibrium point to reveal the details and highlight the input image. 2. Reducing the dynamic range of the processed image and creating an improved image.

3.1 INCREASING DYNAMIC RANGE

HDR-TV image formats are based on the two main concepts of Perceptual Quantizer (PQ) and HLG. In HLG format, an Opto-Electronic Transfer Function (OETF) converts the light of a real scene recorded on a camera into a video signal on an HDTV. In fact, this format automatically provides a degree of compatibility commensurate with the monitor [16–18]. Due to this feature, some functions in the HLG format have been selected as tools to enhance the dynamic range. The process of increasing the dynamic range consists of several steps. First, the values of the input image are normalised in the range of zero to one, and its luminance is obtained according to Equation (1). In the next step, a linear mapping function based on Equation (2) is applied to it:

$$L = 0.2126R + 0.7152G + 0.072B \quad (1)$$

$$L' = a \times L + \delta \quad (2)$$

Where R, G, and B represent the colour channels of the input image and a is a certain amount in OETF and δ is a very small parameter that prevents the creation of absolute zeros in the values. In fact, Equation (2) is a preprocessing step before entering the HLG domain. Now, the image L' enters the HLG domain using OETF [18] (Equations (3) and (4)):

$$E' = OETF(L') = \begin{cases} \sqrt{3 \times L'} & 0 \leq L' \leq 1/12 \\ a \times \ln(12 \times L' - b) + c & 1/12 \leq L' \leq 1 \end{cases} \quad (3)$$

$$a = 0.17883277 \quad b = 1 - 4a \quad c = 0.5 - a \times \ln(4a) \quad (4)$$

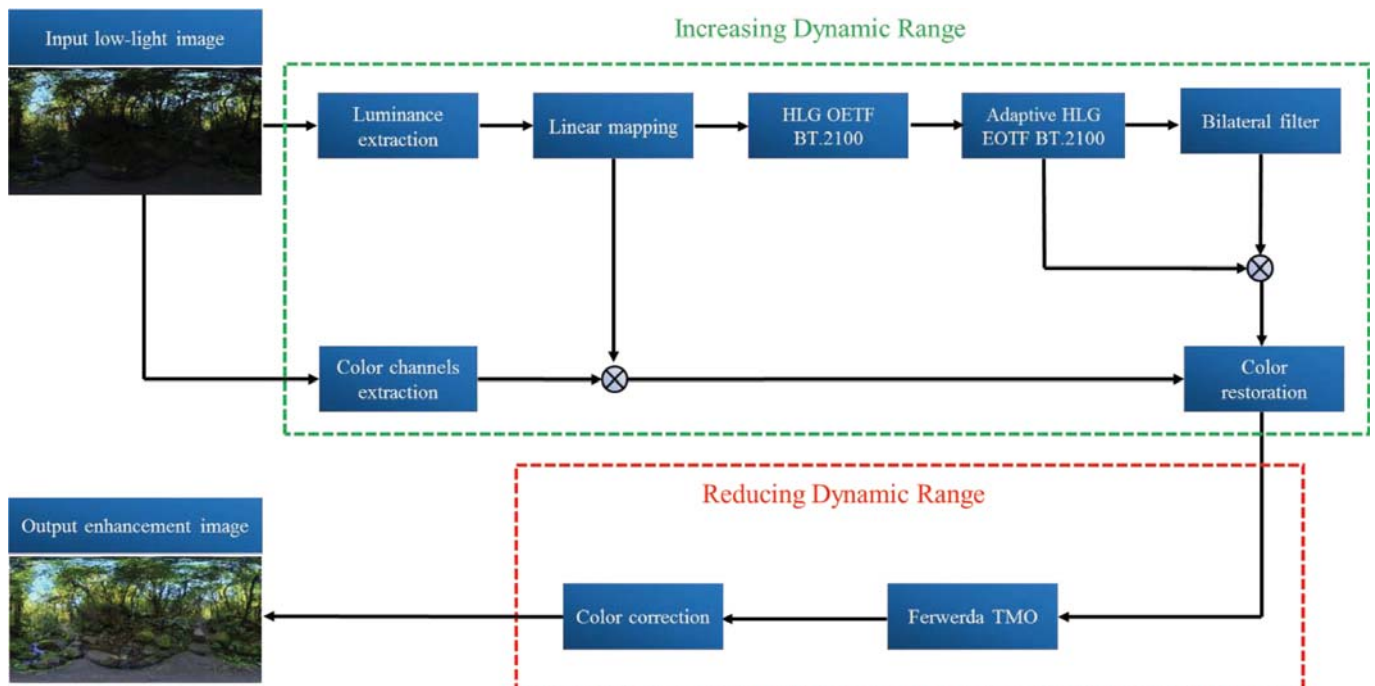


Figure 1 : The framework of the proposed method.

In the BT.2100 standard [18], another function for HLG is defined as EOTF, which is expressed by Equations (5) to (7):

$$EOTF(\max(0, (1 - \mu) \times E' + \mu)) = OOTF(OETF^{-1}(\max(0, (1 - \mu) \times E' + \mu))) \quad (5)$$

$$\mu = \sqrt{3 \times (L_B / L_W)^{1/\gamma'}} \quad (6)$$

$$OOTF(K) = L_W \times K^{\gamma'} \quad (7)$$

Where L_W and L_B represent the maximum and minimum luminance that a monitor can provide, respectively, and γ' is a coefficient determined by L_W . In order to reach the desired equilibrium threshold and enhance the dynamic range, the luminance values of a 1000-nit monitor are considered and therefore L_W , L_B and γ' are set to 1000, 0.005 and 1.2, respectively. On the other hand, Equation (5) is adapted based on the desired process and becomes Equation (8):

$$Z = OOTF(\max(0, (1 - \mu) \times E' + \mu)) \quad (8)$$

In this step, the image E' obtained from Equation (3) enters Equation (8), and the image Z is obtained. The resulting image is then entered into the bilateral filter [19]. The bilateral filter is a nonlinear filter that replaces the intensity of each pixel with the weighted average of the intensity values of the adjacent pixels and performs domain and range filtering simultaneously. This filter effectively blurs the image but keeps sharp edges intact. Using the Gaussian G function, the two-sided filtered version I_p^b of the black-and-white image Z is defined as Equation (9):

$$I_p^b = \frac{1}{W_p^b} \sum_{q \in S} G_{\sigma_s}(\|p - q\|) G_{\sigma_r}(|Z_p - Z_q|) Z_q \quad (9)$$

$$W_p^b = \sum_{q \in S} G_{\sigma_s}(\|p - q\|) G_{\sigma_r}(|Z_p - Z_q|) \quad (10)$$

Where Z_p and Z_q are related to the pixel values at positions p and q in the image Z , and σ_r and σ_s are the standard deviations of Gaussian functions for range and space domains and W_p^b is the normalization factor. To highlight the elements, the image obtained from the bilateral filter is inverted and multiplied by the square of the image Z to obtain image H . In fact, in addition to developing contrast, the animation of the input image also occurs because reversing the bilateral filter sharpens the image and adds depth to it. Next, the colour is returned to the resulting image using Equation (11) and we call the coloured output D :

$$C_{out} = \frac{H \times C_{in}}{L'} \quad (11)$$

Where C_{out} represents the colour channels of the output image D and C_{in} represents the colour channels of the input image at the beginning of the process, and L' corresponds to Equation (2).

3.2 REDUCING DYNAMIC RANGE

The image D obtained at the end of the previous step has a higher dynamic range than the input content. However, our ultimate purpose of enhancing the contrast must be achieved in a situation that has the same dynamic range as the input image. In addition, given that the degree of compatibility of dynamic domain reduction methods differs from the content,



Figure 2 : Examples of results obtained by different TM methods for input image D , along with the input image at the beginning of the process

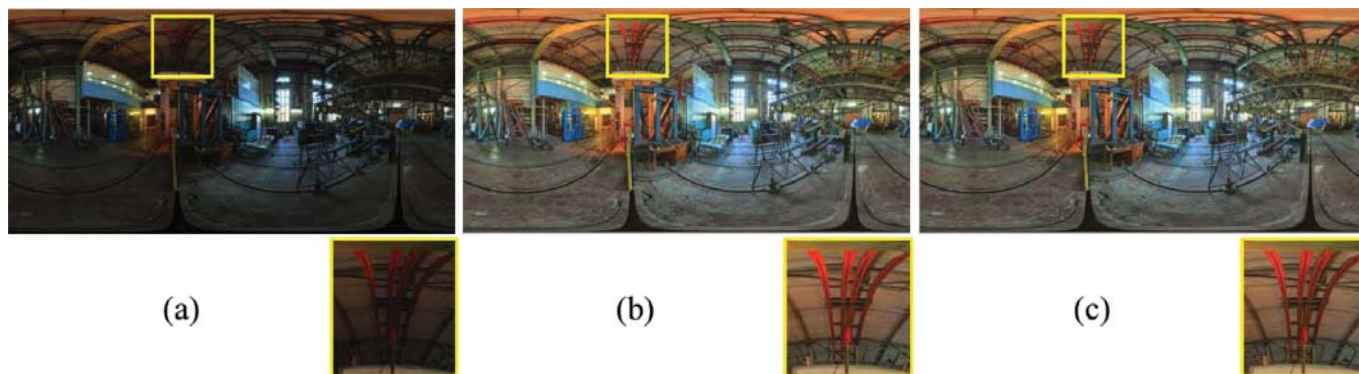


Figure 3 : The effect of the colour correction on the output of the proposed process.
(a) Input low-light image. (b) Output without colour correction. (c) Output with colour correction.

and each leads to the creation of images with different appearances, different Tone Mapping (TM) methods should be considered to obtain the desired output for different types of content. It is worth noting that this matter was also considered in the initial design, and the purpose of increasing the dynamic range to an equilibrium point is to develop light values up to a threshold that a variety of TM methods can implement in that dynamic range, and this approach can lead to creating different images of the input image where each of them reflects a different result. In this regard, according to image D obtained at the end of the previous step, several TM approaches [20–39] were considered, and finally Ferwerda TM [20] was selected. Examples of the output image obtained with several TM methods, along with the input image at the beginning of the process, are shown in **Figure 2**.

As can be seen in the **Figure 2**, each of the adopted TM operators creates a different image at the end of the proposed process. The results in the second column show more detail of the image but are unable to indicate the colour of the main scene. The results in the third column provide a high density of colour while revealing less details about the scene. But in the fourth column, the Ferwerda TM [20] results create the correct concentration of colour in a situation where the details in the dark areas of the image are also revealed to the desired extent.

TM techniques are unable to restore the original scene's colour during the dynamic range reducing process. Although, as shown in **Figure 2**, the selected TM approach provides better performance for our process than other approaches, we use the Pouli colour correction [40] at the end of the process to preserve the original image and create a better result.

Figure 3 shows an example of the output of our process after adding colour correction. As can be seen, although there is very little difference in whether we use colour correction, this gives us a more natural output.

4. RESULT AND DISCUSSION

To compare the proposed method with other methods, objective tests and visual comparisons are used. In these tests, the proposed method is compared with the following methods: Multi Scale Retinex with Colour Restoration (MSRCR) [7], Bio-Inspired Multi Exposure Fusion (BIMEF) [12], Naturalness Preserved Enhancement algorithm (NPE) [41], dehazing based method (Dong) [42], Simultaneous Reflection and Illumination Estimation (SRIE) [43], and Illumination Estimation based method (LIME) [44]. To create the same conditions, the mentioned methods have been implemented with Matlab 2019a on a Core i7-2760QM CPU at 2.4 GHz,

8.00 GB of RAM, and 64-bit, and their parameter values have been selected by default based on the recommendations of their authors. In these evaluations, we test those methods with the images from four public datasets and the various images taken from the website, which are as follows:

LIME data [44]. This dataset consists of 10 images used in [44].

Ex-Dark data [45]. This dataset contains 12 groups of low-light images, including bicycle, boat, bottle, bus, car, cat, chair, cup, dog, motorbike, people and table. 381 images from this collection are used for evaluation.

DICM [46]. It includes 69 images that have been prepared by [46].

HDRI Haven [47]¹. It contains 80 low-light images, including a wide range of landscapes, urban areas, etc., which are collected from the website [47] and have an exposure value of -4.

4.1 OBJECTIVE EVALUATION

In objective evaluation, we use Peak Signal-to-Noise Ratio (PSNR) [48], Lightness Order Error (LOE) [41], and Dynamic Range Independent Metric (DRIM) [49]. The PSNR is used to measure the denoising effect in the image, and the higher the number in this metric, the smaller the difference between the input and output image. To measure the difference in Lightness between the original image and the processed image, the LOE criterion is offered. The lower the value of the LOE, the better the order of Lightness. DRIM detects visible distortion between two images and is independent of the dynamic range of the image. The resulting image is a summary image with red, green, and blue pixels indicating whether the contrast in the produced image is reversed, reduced, or improved. Red pixels mean that the contrast of these pixels is reversed; green pixels indicate that the contrast of these pixels has disappeared; and blue pixels indicate that the contrast of these pixels has been amplified. The contrast reversal map in this analysis is disabled because it has proven to be an inaccurate indicator of artifacts. The results of the DRIM are shown in **Figure 4**, and the results of the PSNR and LOE are shown in **Tables 1** and **2**. As shown in **Figure 4**, with the least distortion, the proposed method achieves the most realistic results. **Tables 1** and **2** show the good performance of the proposed method.

¹ https://uupload.ir/view/wkh9_cebdr_c_dataset.rar/

Table 1. Quantitative measurement results of PSNR (blue, red, and green indicate the best, second-best, third-best results respectively)

Dataset	BIMEF	DONG	LIME	MSRCR	NPE	SRIE	OUR
Bicycle (Ex-Dark)	14.87	13.76	9.46	7.47	14.93	19.68	15.65
Boat (Ex-Dark)	15.25	13.26	9.42	7.55	14.1	18.65	15.24
Bottle (Ex-Dark)	15.66	13.93	9.69	7.33	14.21	19.45	16.37
Bus (Ex-Dark)	14.88	13.34	9.52	8.03	14.51	19.72	15.04
Car (Ex-Dark)	15.4	13.3	9.52	7.75	13.56	19.08	15.76
Cat (Ex-Dark)	14.91	13.06	9.23	7.04	13.72	18.87	15.39
Chair (Ex-Dark)	15.45	12.7	9.2	7.43	14.65	18.39	15.56
Cup (Ex-Dark)	15.3	13.84	9.95	7.53	14.68	19.44	16.19
Dog (Ex-Dark)	14.76	12.28	8.61	6.53	12.9	18.17	14.65
Motorbike (Ex-Dark)	15.2	14.08	9.67	7.41	15.36	20.16	16.05
People (Ex-Dark)	15.17	13.52	9.48	7.84	14.96	19.12	15.2
Table (Ex-Dark)	14.7	12.73	8.92	7.3	13.74	18.51	15.31
LIME	14.62	12.75	8.86	7.16	14.03	18.54	14.6
DICM	17.36	14.16	10.64	9.07	18	20.01	15.91
HDRI Haven	13.65	9.74	7.74	5.77	11	15.53	13.96

Table 2. Quantitative measurement results of LOE (blue, red, and green indicate the best, second-best, third-best results respectively)

Dataset	BIMEF	DONG	LIME	MSRCR	NPE	SRIE	OUR
Bicycle (Ex-Dark)	238.64	434.36	914.15	800.23	525.57	239.88	322.41
Boat (Ex-Dark)	213.6	380.97	837.54	852.45	457.6	221.35	298.96
Bottle (Ex-Dark)	209.88	292.68	648.44	796.22	515.19	238.86	318.19
Bus (Ex-Dark)	218.75	436.05	821.47	656.43	504.6	280.19	319.03
Car (Ex-Dark)	198.76	314.18	680.86	825.11	484.45	230.24	312
Cat (Ex-Dark)	184.14	326.85	719.32	794.1	510.46	206.93	291.08
Chair (Ex-Dark)	186.42	322.63	735.3	782.23	452.02	206.92	284.64
Cup (Ex-Dark)	172.94	316.9	652.53	685.32	464.91	240.61	235.58
Dog (Ex-Dark)	209.72	437	823.32	992.36	538.39	253.28	294
Motorbike (Ex-Dark)	221.03	364	930.98	914.16	451.56	224.07	300.38
People (Ex-Dark)	229.85	477.2	900.46	900.43	540.49	260.02	399.13
Table (Ex-Dark)	197.81	333.27	727.47	715.77	526.66	238.9	308.55
LIME	136.89	241.4	793.89	864.67	334.92	106.3	257.79
DICM	298.12	440.82	1094.38	1153.35	310.91	266.4	465.06
HDRI Haven	295.52	607.5	1105.4	1448.07	705.67	232.58	418.25

Although, unlike the SRIE, we do not control noise separately, and unlike BIMEF, we do not separate the dark areas of the image, our objective results in noise control and maintenance of the lightness order are close to those of the BIMEF and SRIE methods. Further analysis and assessment of the performance of other methods in the fields referred to above will be comprehensively indicated in visual comparisons.

4.2 VISUAL EVALUATION

In visual assessment, we consider different comparisons. These include the preservation of artistic aims, the confrontation with artifacts, and the issue of colour accuracy.

A. Preservation of artistic aims

Some methods aim at the naturalness of the output image, because the increase in contrast in low-light areas is sometimes so great that these areas become blurred and

faded. Although these methods try to restore the colour of the original scene, they usually do not pay attention to the artistic goals of the original image. Among the artistic goals in the images are shadows and borders between dark and bright regions. Therefore, it is important to maintain and present these areas correctly. Figure 5 shows non-uniform low-light images in which beams of light were mixed with dark areas. NPE, DONG and MSRCR are not capable of providing shadows correctly and maintaining the boundaries between dark and bright areas. LIME Although it provides a good picture (note the shadow of the windows in the figure on the left), it produces too much contrast in the bright areas (note the bright area in the figure on the right). However, SRIE cannot provide shades such as LIME, but it creates a uniform contrast for both dark and bright areas. BIMEF has almost the same results as the proposed method, but the superiority of the proposed method is obvious.

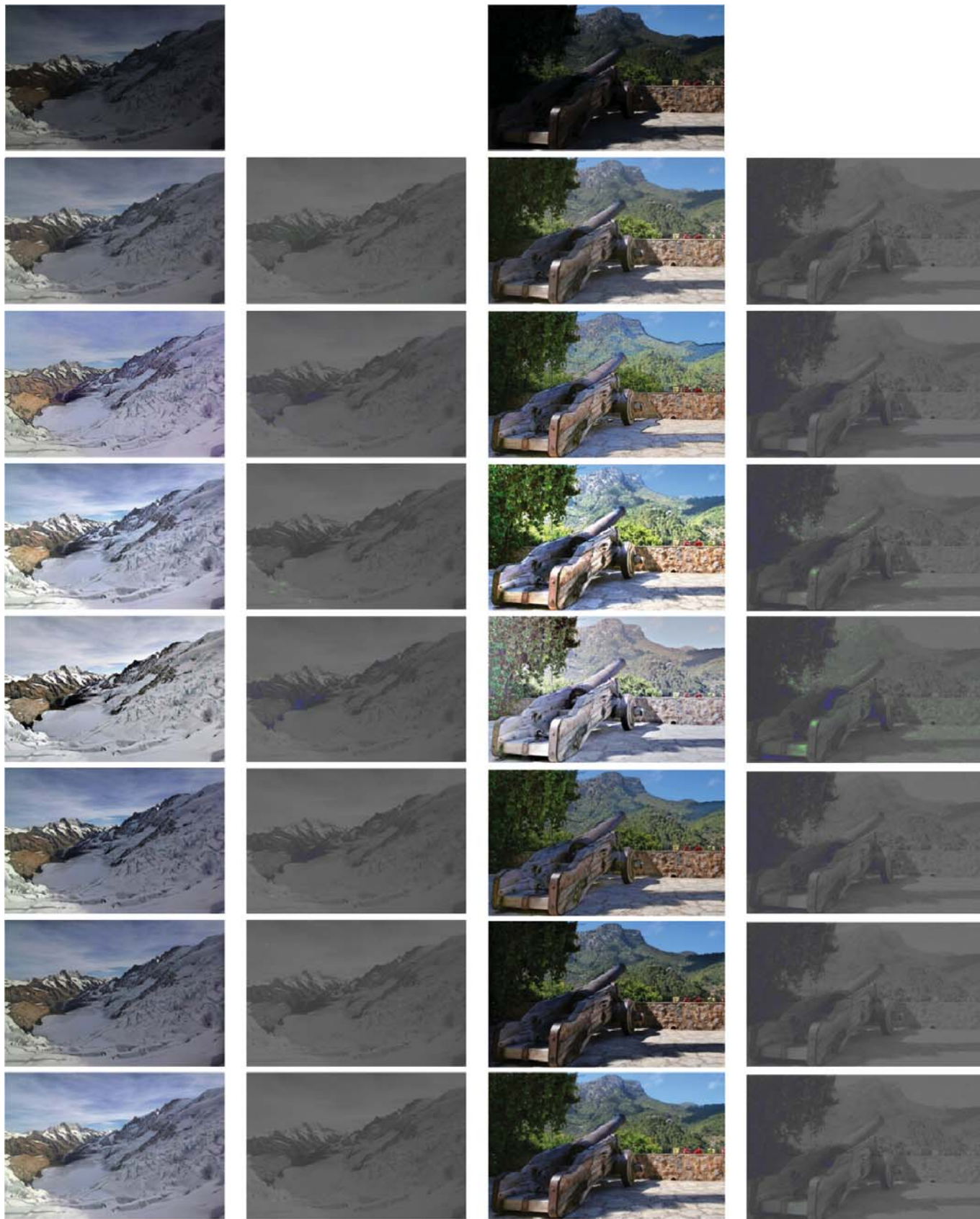


Figure 4 : Comparison of contrast distortion obtained by [49]. The images from the first to the last rows are the original images, enhanced images by BIMEF [12], DONG [42], LIME [44], MSRCR [7], NPE [41], SRIE [43], and the proposed method, respectively.

B. Confrontation with artifacts

Some methods focused on revealing more detail, but too much contrast can lead to the appearance of artifacts in the image that were not previously visible. Therefore, the rate of detection should be such that fewer artifacts appear in the final image. With the accompanying enlargements in green, red and yellow rectangles, Figure 6 displays the enhanced results. LIME and MSRCR create a lot of contrast, which can cause the artifacts to appear and some of the details to be lost in the image. NPE has produced better results than they have been, but a lot of noise is still visible. Unlike DONG, SRIE works

well against noise, but generally produces less contrast. BIMEF has almost the same results as the proposed method, but the superiority of the proposed method is obvious.

C. The issue of colour accuracy

Some approaches have placed the confrontation with visual artifacts on their agenda, but they have ignored the issue of colour accuracy. The processed image should be able to display details in dark areas with the correct colour accuracy. Figure 7 shows the results of various methods for different types of indoor and outdoor environments.

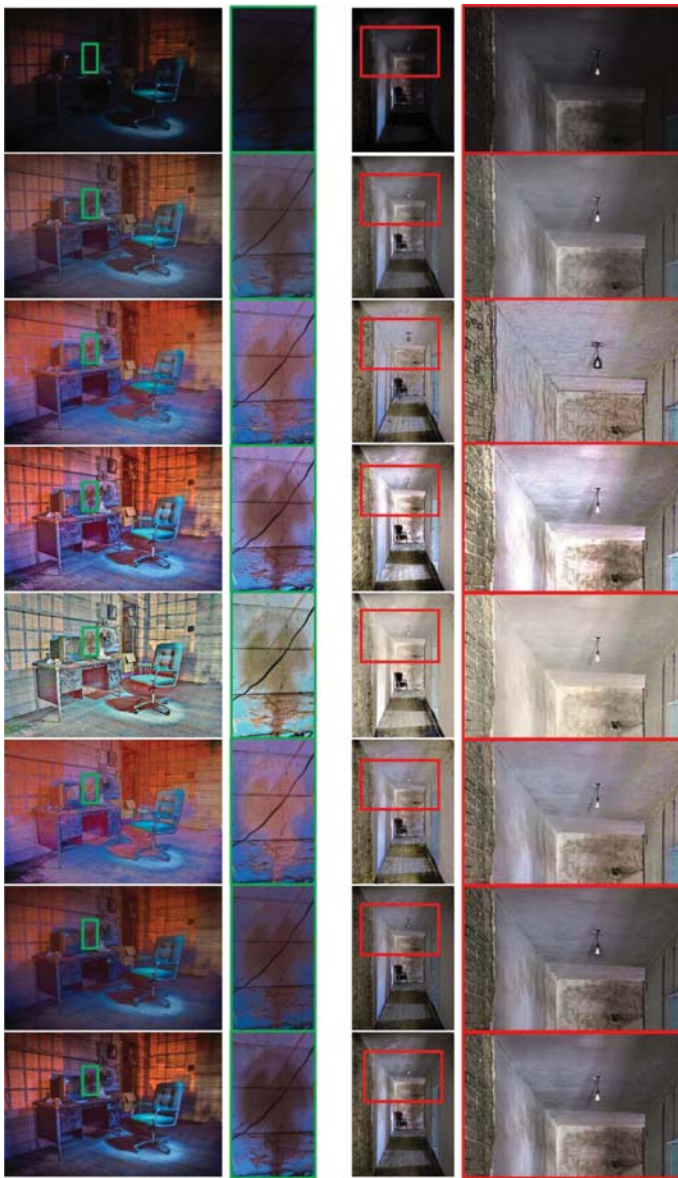


Figure 5 : Comparisons of the preservation of artistic aims. The images from the first to the last rows are the original images collected by [45], enhanced images by BIMEF [12], DONG [42], LIME [44], MSRCR [7], NPE [41], SRIE [43], and the proposed method, respectively.

As can be seen, the results of DONG and NPE look like works of art. In other words, increasing colour density in this way, instead of creating more natural images, has created watercolour images. In addition, DONG is not capable of presenting the boundaries correctly. The results of MSRCR are so bright that it is difficult to detect different objects on the scene, and sometimes it is impossible to see details in bright areas. This method works by adding a white filter to the input image and blurring all areas of the image, both dark and bright. LIME sometimes provides eye-catching images (like Teufelsberg) but, like MSRCR, it is unable to retain some detail (see the sunlight between the clouds in the church image) and creates too much contrast in bright areas. In BIMEF results, the colours are visible with a small concentration. In fact, this approach focuses on revealing details in low-light areas and is unable to provide the true colour concentration of the scene. Hence, the final image is lifeless, giving the viewer the feeling that they do not have depth images. Unlike BIMEF, SRIE produces good colour concentration but does not have enough sharpness (note the light sources in the lobby). Our proposed method, in addition to producing natural and vivid images, shows the objects of the image with the appropriate colour concentration. One reason for this is the use of an inverted bilateral filter that adds depth to the final image. The HLG system is also another factor that influences the performance of the proposed method, because creating

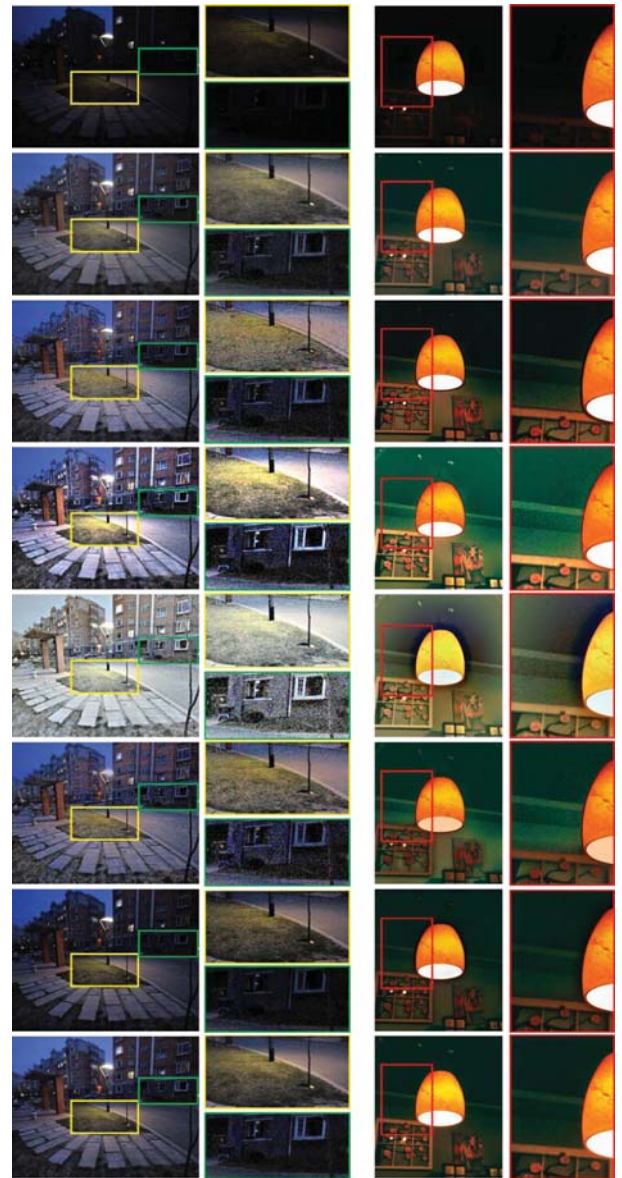


Figure 6 : Comparisons of the confrontation with artifacts. The images from the first to the last rows are the original images collected by [44], enhanced images by BIMEF [12], DONG [42], LIME [44], MSRCR [7], NPE [41], SRIE [43], and the proposed method, respectively.

compatibility between the amount of light in the input image and the screen light can improve the quality of the viewer experience. These show the realisation of our goal, including naturalness and proper concentration of colour, while revealing details.

5. CONCLUSION

In this paper, a method to improve the contrast of low-light images based on dynamic range changes is proposed. To this end, the optical values of the input image are first extracted and transferred to the high dynamic range ecosystem using the HLG format. Next, by creating depth with the bilateral filter, the dynamic range of the input image is amplified to the equilibrium threshold, and then the enhanced output is achieved by reducing the dynamic range. Based on this framework, we have simultaneously taken effective steps to ensure that details are revealed to the extent desired, that the output image remains natural, and that the artistic objectives of the image are maintained. To measure the effectiveness of the proposed approach, we carried out objective and visual measurements in comparison with other methods. The scores obtained in the objective tests and the obvious occasions in the visual tests show the good performance of the proposed method. One of the most important features of the proposed method is that bright pixels are kept as similar as possible to the original samples, while dark pixels are greatly amplified.

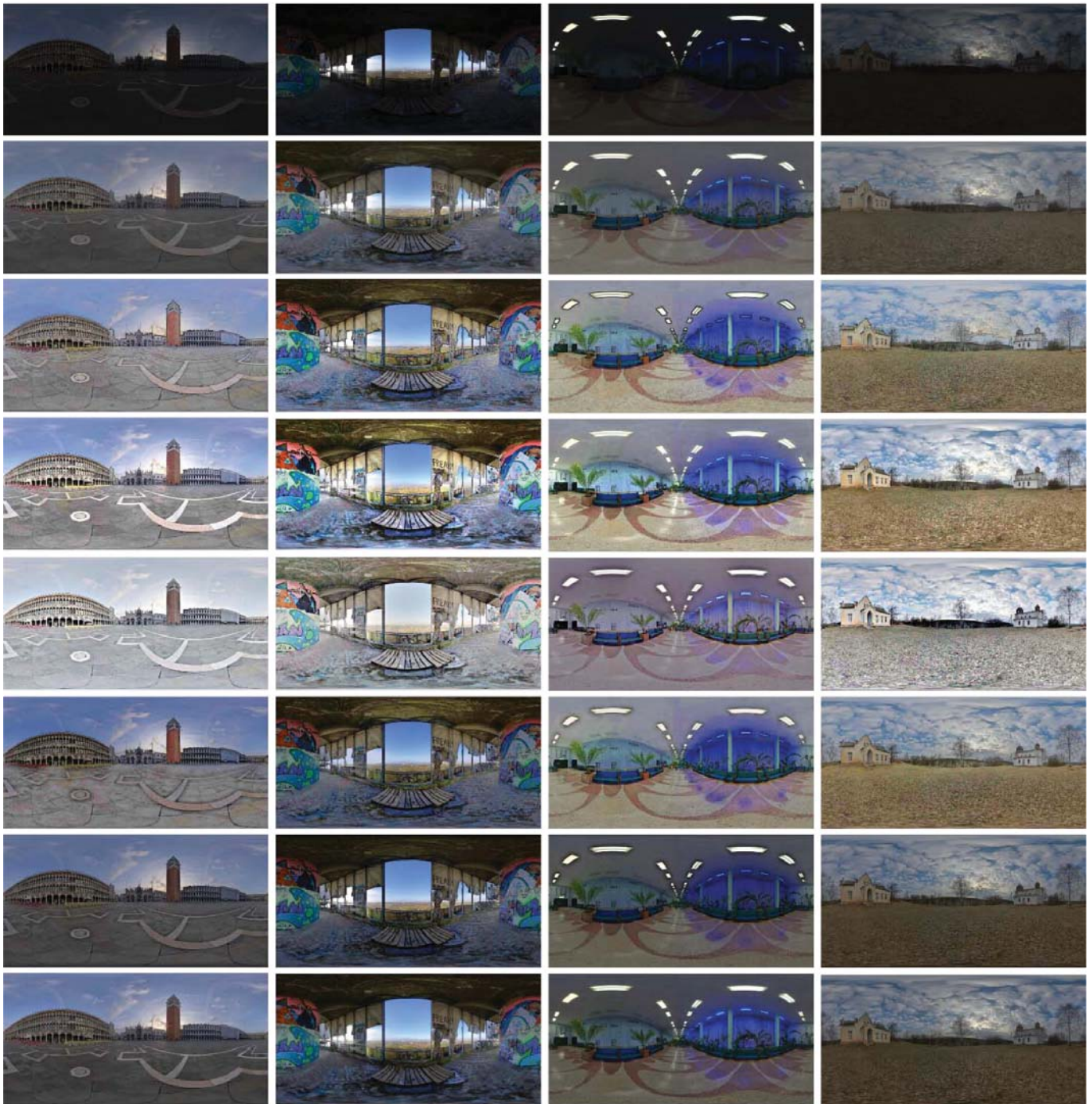


Figure 7 : Comparisons of the issue of colour accuracy. The images from the first to the last rows are the original images collected by [47], enhanced images by BIMEF [12], DONG [42], LIME [44], MSRCR [7], NPE [41], SRIE [43], and the proposed method, respectively.

This feature makes our approach, in addition to being efficient for images that only include dark areas, also suitable for enhancing the contrast of images with light and dark areas. Simplicity in execution, appropriate colour concentration, depth of the output image, and its naturalness are other features of the proposed method that significantly improve the visual quality perceived by the viewer.

Despite these advantages, **Figure 8** shows the failure of the proposed process. As can be seen, our approach sometimes leads to the emergence of halo artifacts. This problem may be caused by the use of the bilateral filter or in the approach taken to reduce the dynamic. One way to address this problem is to use colour correction repetitively or to use several dynamic range reduction methods side by side, while only one tone mapping method has been used in the proposed method. **Figure 9** shows the halo artifacts problem, which has always been a challenge for contrast improvement methods. As can be seen, other methods sometimes lead to

the creation of halo artifacts to varying degrees. As a result, we will address this issue in future work.



Fig. 8. An example of a failure case.
(a) Input image collected by [47]. (b) Enhanced by the proposed method.

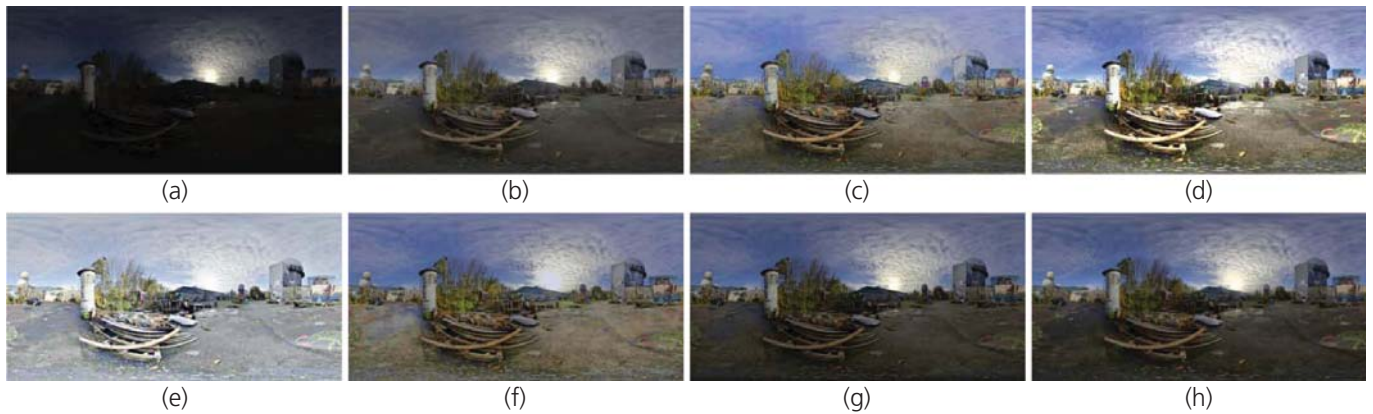


Figure 9 : Halo artifacts problem, which has always been a challenge for contrast improvement methods.

(a) Input image collected by [47]. (b)-(h) enhanced images by BIMEF [12], DONG [42], LIME [44], MSRCR [7], NPE [41], SRIE [43], and the proposed method, respectively.

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IRIB R&D

has made major advances in applying basic research and innovation in media technology. It develops innovative new products and technologies in broadcast/broadband industry that leads the development of future technologies in IRIB. Core research themes at IRIB R&D include deep learning and AI based services, intelligent OTT services, Internet of Things, HbbTV, development of transmission via terrestrial and satellite systems, cloud-enabled networking, IP-based content production and contribution.

Our R&D projects often involve collaborations with public or private entities, including universities, government laboratories, technology start-ups and incubators, research institutes and partner companies. IRIB R&D scientists also partner with local universities to share expertise and resources.



Pirouz Gostar Cinema Technology Development (PG CineTech) is an Iranian company established in 2005 with the aim of delivering high quality and professional services to the Cinema and Film Industries.

The main goal of PG CineTech is to be the "Pioneer Service Organization" that enables and empowers customers to lead their businesses successfully through the use of robust, durable, intuitive, ergonomic, and reliable products. The main products and services offered by PG CineTech include:

- Fluid Head and Tripod
- Phoenix Crane
- Traveling System
- Pedestal.



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PIROUZ
MOVIE TECH

ABU PARTICIPATES IN BROADCASTASIA 2024 IN SINGAPORE | 29-31 MAY 2024



The BroadcastAsia 2024 event, hosted in Singapore from 29 to 31 May, featured active participation from the Asia-Pacific Broadcasting Union (ABU) and prominent media organisations. Notable attendees included Televisi Republik Indonesia (TVRI), Radio Republik Indonesia (RRI), Sri Lanka Rupavahini Corporation (SLRC), Singapore's Mediacorp, Whiteways and the Cambodian Broadcasting Service (CBS).

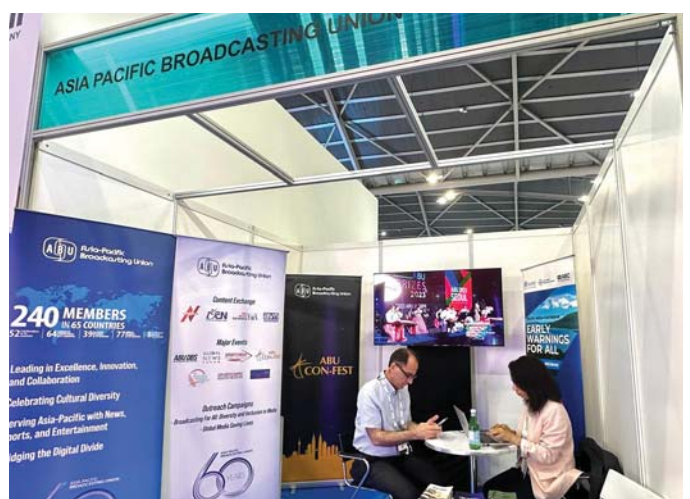
This leading event served as a platform to showcase cutting-edge technologies and industry trends, while also fostering networking and collaboration among global leaders in the broadcasting and

media sector.

At the event, ABU and its members actively participated in in-depth discussions with industry peers, media professionals, and technology experts. These conversations covered key industry trends, regulatory challenges, and best practices. Participants gained valuable insights into emerging trends, market dynamics, and consumer behaviours that are shaping the media landscape. The event featured keynote speeches, panel discussions, and presentations by industry experts, providing a comprehensive overview of the opportunities and challenges facing the sector.

A notable moment at the event was a keynote speech by David Ulmer, CEO of CBS, during the 'AI in Broadcasting: Revolution or Evolution' session. Ulmer highlighted the lasting importance of artificial intelligence (AI) in the broadcasting industry, stating that AI is set to continue and further develop within the industry.

Events such as BroadcastAsia is important in promoting dialogue, fostering innovation, and encouraging collaboration especially as the media and broadcasting industry are facing rapid transformation. ■





News from The ABU Region

SAUDI LAUNCHES TELEVISION AND RADIO TOWERS INFRASTRUCTURE PPP PROJECT

Saudi Arabia has launched a Public-Private Partnership (PPP) project to modernize and expand the Kingdom's television and radio infrastructure. Led by the Saudi Broadcasting Authority (SBA) in collaboration with the National Centre for Privatization & PPP (NCP), the initiative invites expressions of interest (EOI) to develop and operate SBA's towers infrastructure at 143 locations under a 25-year Rehabilitate-Finance-Operate-Maintain-Transfer (RFOMT) contract. The project aims to bolster TV and radio services by upgrading all TV sites from DVB-T/Analog to DVB-T2 technology, increasing channel offerings, and ensuring robust maintenance and operational standards through private sector involvement. [\[ABU News\]](#)

ABC RADIO AUSTRALIA LAUNCHES IN TUVALU

The Australian Broadcasting Corporation (ABC) has achieved a significant milestone with the launch of ABC Radio Australia on FM in Tuvalu, expanding its reach and impact in the Pacific region. Tuvalu listeners can now access a comprehensive array of Pacific-focused news, music, sports, and cultural programming on 102FM, marking the network's debut in the island nation.

In a ceremony held in Funafuti, Tuvalu, the ABC and the Tuvalu Broadcasting Corporation (TVBC) formalized their partnership by signing a Memorandum of Understanding (MOU). This MOU highlights the commitment of both broadcasters to collaborate on technical knowledge sharing and content exchange, strengthening their roles in delivering public interest broadcasting to their respective audiences.

Claire M. Gorman, Head of ABC International, expressed enthusiasm about the collaboration and the launch of ABC Radio Australia in Tuvalu. She highlighted the significance of the Memorandum of Understanding (MOU) in deepening the partnership between ABC and TVBC, paving the way for future initiatives to support audiences in Tuvalu and Australia.

Yvette D'Unienville Isaac, Managing Director of TVBC, echoed these sentiments, welcoming the new FM service and emphasizing the opportunities for cross-cultural exchange and information sharing facilitated by the MOU.

ABC Radio Australia has recently expanded its FM transmission to several other Pacific locations, including Nauru, Palau, Pohnpei (Federated States of Micronesia),

Kokopo (Papua New Guinea), and Gizo (Solomon Islands). The network plans further expansions in the coming months, with upcoming launches scheduled for Kiribati, the Cook Islands, the Marshall Islands, Lorengau in Papua New Guinea, and Buka in the Autonomous Region of Bougainville.

This development underscores ABC's commitment to enhancing its presence in the Pacific and providing diverse, high-quality content to audiences across the region. Stay informed about ABC Radio Australia's continued expansion and its impact on regional broadcasting by following their latest initiatives and partnerships. [\[Content+Technology\]](#)

TUCSON TV STATIONS LAUNCH NEXTGEN TV SERVICES

In a significant development for broadcast television technology, six stations in the Tucson, Arizona area have successfully launched NextGen TV, also known as ATSC 3.0 broadcasts. This advancement promises enhanced audio and video quality, along with revolutionary interactive features that transform over-the-air television viewing.

The stations leading this technological leap include NBCUniversal Local's KHRR-TV/Telemundo 40 (channel 40.1), Allen Media Broadcasting's KVOA-TV/NBC (channel 4.1), Gray Television's KOLD-TV/CBS (channel 13.1), KUAT-TV/PBS (channel 6.1), Scripps KGUN-TV/ABC (channel 9.1), and Tegna's KMSB-TV/FOX (channel 11.1). Acting as the host station for NextGen TV broadcasts in Tucson, KHRR-TV of Telemundo plays a pivotal role in ushering in these innovative capabilities.

Clarence Hau, Senior Vice President of Standards, Policy & Emerging Technology at NBCUniversal, highlighted the ground-breaking aspects of NextGen TV. He emphasized that besides delivering superior audio and video quality, this technology enables personalized and interactive experiences previously unavailable over-the-air. Features such as the ability to restart programs and access additional content enhance viewer engagement and satisfaction.

NextGen TV represents a significant evolution beyond traditional broadcasting capabilities. It supports High Dynamic Range (HDR) video, interactive content, datacasting, and other advanced services. This technological advancement not only enhances the viewing experience but also opens new avenues for

broadcasters to innovate and engage audiences in novel ways.

TV Tech continues to monitor and report on the nationwide rollout of NextGen TV broadcasts. Each launch represents a step forward in leveraging cutting-edge technology to redefine television broadcasting standards and capabilities. [TV Tech]

SENTIMENT ANALYSIS TECHNOLOGY FOR THE PURPOSE OF SOCIAL MEDIA PUBLIC OPINION ANALYSIS

The Science & Technology Research Laboratories (STRL) is at the forefront of research in computer science, with a focus on advancing collaborative content production between humans and machines. Their efforts center around leveraging Artificial Intelligence (AI) and data analysis to improve program production efficiency and web content creation.

In collaboration with the NHK Broadcasting Culture Research Institute, STRL is working on developing sentiment analysis technology for social media public opinion analysis. The research aims to accurately recognize emotion labels (such as positive, negative, neutral, etc.) expressed in social media posts.

Understanding these emotions is crucial for interpreting public sentiment and tracking changes over time, similar to traditional public opinion polls.

Recognizing the challenge posed by the brevity of social media posts, STRL has introduced a novel approach

to improve sentiment analysis accuracy. Their method combines outputs from existing discriminative models with a database for similar case searches. This hybrid approach involves:

- Sequentially inputting utterances of identified objects into the conventional identification model to create emotion label probability distributions.
- Searching for similar content in a database to establish a similarity-based probability distribution.
- Combining these distributions through weighted linear summation to yield a final probability distribution, determining the predominant emotion label with the highest probability.

Experimental evaluations have shown promising results, with improved recognition performance observed across two out of three commonly used emotion recognition datasets compared to conventional methods. This validates the effectiveness of STRL's approach in enhancing sentiment analysis precision.

Moving forward, STRL aims to further refine their methodology to achieve even higher recognition accuracy. Future efforts will focus on integrating these advancements into practical applications for social media public opinion analysis. Ultimately, STRL's goal is to develop a robust sentiment analysis system that supports comprehensive and insightful assessments of public sentiment across diverse social media platforms. [NHK STRL]

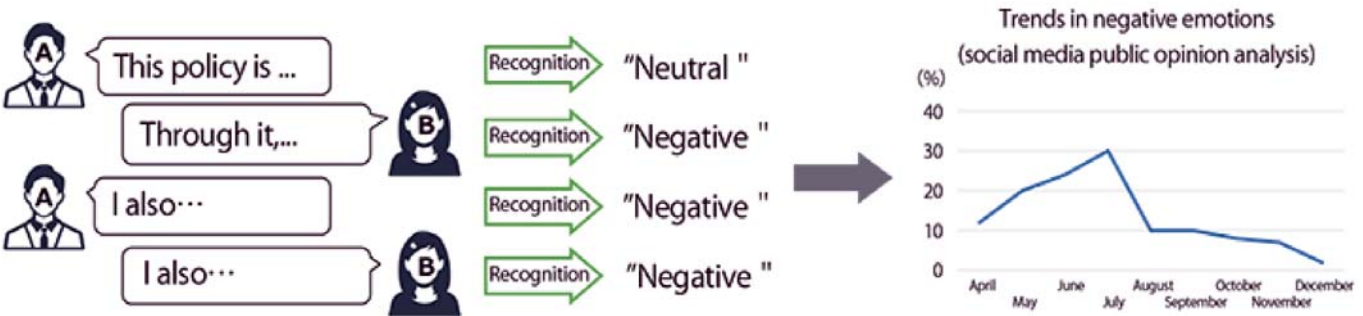


Figure 1: Emotion recognition of utterances posted on social media and the social media public opinion analysis

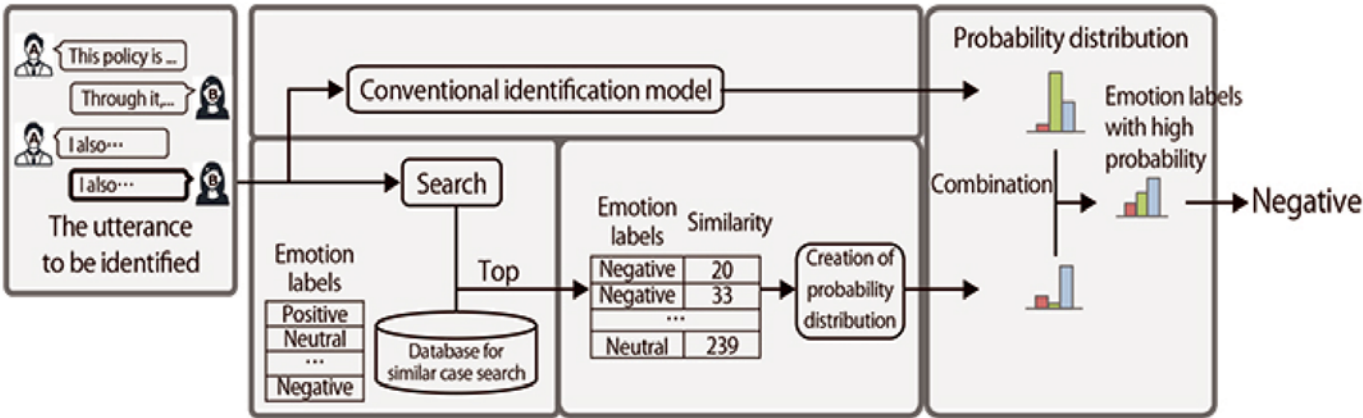


Figure 2: Flow of the proposed method utilizing the database for similar case search

VIETNAM'S VTV5 SELECTS ETERE FOR THREE CHANNELS

VTV5, a prominent state-owned channel serving 54 ethnic dialects across Vietnam, has recently upgraded its broadcasting infrastructure to the advanced Etere Ecosystem. This upgrade, aimed at meeting the needs of its diverse and expanding audience base, integrates sophisticated software solutions to optimize playout operations across three key channels: VTV5 Hanoi, VTV5 Tay Nguyen, and VTV5 Tay Nam Bo.

The decision to adopt Etere Ecosystem followed a rigorous evaluation process, where VTV5 identified Etere's integrated software framework as the ideal solution to streamline workflows and enhance operational efficiencies across distributed teams. Key components of the Etere Ecosystem deployed for the VTV5 Project include:

- **Etere Automation:** A robust playout automation system that seamlessly integrates real-time device control with Media Asset Management (MAM), ensuring smooth broadcast operations.
- **Etere Executive Scheduling:** Designed for efficient planning of both short-term and long-term playlists, integrating licensed content, commercials, imported materials, and regional ad insertions into meticulously planned schedules.
- **Etere T-Workflow:** Empowers broadcasters with comprehensive tools to optimize and orchestrate workflows, managing the entire media lifecycle in synergy with the Etere Media Asset Management (MAM) system.
- **Etere Basic Media Asset Management (MAM):** Provides essential asset organization capabilities bundled with every Etere system, delivering a cost-effective solution without compromising functionality.
- **Etere Media Manager:** Facilitates seamless transfer,

duplication, and relocation of media assets across various hierarchical levels, governed by customizable workflow protocols.

- **Etere Ingest:** Supports various ingestion needs, including manual, scheduled, and automatic operations, ensuring efficient media content acquisition.
- **Etere Web:** Enhances information exchange across internal departments, personnel, and external stakeholders, fostering collaboration and streamlined communication.
- **Etere SNMP Console:** Offers centralized real-time system monitoring, enabling proactive management of infrastructure and automatic recovery from service downtime.
- **Etere ActiveSync:** Automates the creation and updating of links between video files and database assets, ensuring data consistency and integrity.
- **Etere F90:** Optimizes data flow between systems, facilitating accurate information import and export through a fully automated, paperless process.

The implementation of Etere Ecosystem at VTV5 signifies a significant advancement in broadcasting technology, enabling the channel to deliver high-quality content efficiently while supporting its mission to serve diverse linguistic and cultural communities across Vietnam. The comprehensive suite of Etere solutions ensures scalability, flexibility, and operational excellence, positioning VTV5 at the forefront of broadcast innovation in the region.

[\[Content+Technology\]](#)

GERMANY'S VRDIRECT UNVEILS VIRTUAL REALITY EXCHANGE FORMAT

Amidst high demand for enterprise-level virtual reality (VR) solutions, German company VRdirect has introduced the VRXF – Virtual Reality eXchange Format.

Introducing Virtual Reality eXchange Format (VRXF)

VRXF File Creation

Any creator/authoring tool is enabled to generate a VRXF file.

VRXF File Sharing

The VRXF File can be shared and stored anywhere.

VRXF File Player

The VRXF file can be played on any VRXF compatible device.



VRXF will standardize VR project creation and sharing across devices.

US patented protected

VRdirect is the developer of an enterprise cloud-based platform which enables creation, deployment, and publication of VR applications. Via the VRdirect platform, projects can be published to all VR-ready devices, mobile devices and web browsers, while the VRdirect cloud allows worldwide distribution and 24/7 availability.

According to the company, the Virtual Reality eXchange Format (VRXF) establishes a new benchmark for creating and sharing VR projects to bring together the currently divided VR market. The VRXF file format, currently patented by VRdirect in the United States, promises to greatly simplify the transfer and usage of VR projects across different devices, including VR headsets, mobile phones, tablets, and web browsers. This advancement marks a significant step in overcoming ecosystem incompatibilities, a major hindrance to VR adoption in the enterprise sector.

VRXF is intended to facilitate an ecosystem of market participants who are integrating VRXF into their offerings. Creator/authoring tools can export VR projects in the VRXF format to leverage the VRXF player infrastructure across devices. Hardware/OEM providers can integrate the VRXF player into their operating systems.

The company says VRXF will allow VRdirect to open its ecosystem to other players like Adobe Photoshop, Figma, Autodesk and many more. With VRXF, enterprises can use VR technology more efficiently for digital transformation. Features of the VRXF File Format:

- **Universal Compatibility:** Ensures that VR projects can be accessed and used on various devices and operating systems.
- **Patented Technology:** VRdirect exclusively owns the rights to this groundbreaking technology, establishing a new industry standard.
- **Seamless Integration:** Hardware partners are encouraged to integrate the VRXF format into their operating systems, simplifying access for enterprise users.
- **Enhanced Efficiency:** Streamlines the creation, editing, and sharing of VR projects, similar to the transformative impact of Adobe Acrobat's PDF files.

[Content+Technology]

SBS MANDARIN & ARABIC NEWS MOVE FROM BROADCAST TO ONLINE

As digital platforms increasingly become the go-to source for news, SBS is adapting its Arabic and Mandarin news services to better meet audience preferences. The Australian multicultural public broadcaster is transitioning its SBS News in Arabic and SBS News in Mandarin from traditional linear bulletins to short-form digital video news packages available throughout the day.

This shift reflects SBS's response to evolving audience habits and aims to enhance the accessibility and relevance of its news content. Mandi Wicks, Director of SBS News and Current Affairs, highlighted that SBS's nightly Arabic and Mandarin news bulletins have been a staple for over

two years. "Our data indicates a growing preference for news on digital platforms", Wicks said. "This transition to digital delivery will allow us to provide timely, regular video updates and expand our in-language content for these communities".

In the past year, SBS has successfully piloted these news packages on third-party platforms, resulting in over 14.7 million views on SBS Arabic's YouTube and Facebook channels and over 8.2 million views on SBS Chinese's YouTube, Facebook, Weibo, and WeChat accounts. Pamela Cook, Acting Director of SBS Audio and Language Content, emphasized SBS's commitment to delivering reliable and impartial news. "This move will increase our ability to offer high-quality digital news coverage around the clock", Cook stated. "We're meeting our audience where they are, on their preferred platforms, with more choice and flexibility".

The Arabic and Mandarin TV news teams will integrate with SBS's established Arabic and Chinese audio and digital programs, focusing on producing shorter, more frequent news updates. This change will result in a significant increase in daily content output, providing more timely and accessible news for these language communities.

Since May 2022, SBS News in Arabic and SBS News in Mandarin have been available on the SBS WorldWatch channel with live news bulletins airing weeknights. However, with nearly half of Australians (49%) using social media for news and online video news consumption on the rise, this update aligns with current viewing trends.

This programming update is part of SBS's broader digital-first strategy, which has expanded its multilingual audio offerings across radio, online, social media, and podcasts. SBS has been recognized as Best Publisher at the Australian Podcast Awards for the past two years and produces over 450 hours of distinctive multicultural content weekly.

According to the latest Australian Census, there are over 367,000 Arabic speakers and more than 685,000 Mandarin speakers in Australia. This digital shift ensures SBS continues to fulfill its Charter by enhancing connection and understanding within Australia's culturally diverse community.

Content will be accessible across all SBS Arabic and SBS Chinese platforms, including their dedicated YouTube channels, the SBS Arabic24 DAB+ channel (rebranded as SBS Arabic), and the SBS Audio website and app, available on the App Store and Google Play. Selected content will also be available on popular podcast and radio streaming services like Apple Podcasts, LiSTNR, Spotify, and TuneIn.

[Content+Technology] ■

DIGITAL BROADCASTING *Updates*

MEDIA LINKS WORLD-FIRST DEMONSTRATION OF STL USING IP/PTP OVER MICROWAVE LINES

Media Links recently achieved a significant milestone by successfully demonstrating the first-ever use of Precision Time Protocol (PTP) and Studio-to-Transmitter Link (STL) using IP over microwave dedicated lines. This groundbreaking achievement holds immense promise for the broadcast industry, specifically in facilitating the transition from traditional coaxial cables to new IP-based technologies. The use of microwave dedicated lines for STLs is a widespread practice in broadcasting stations, making this technological leap a pivotal development for the industry.

The transition to IP-based technologies is rapidly reshaping broadcasting systems. However, the challenge lies in maintaining reliable STLs, which serve as the backbone of many broadcast networks. These STLs often reside in locations, such as mountaintops, where traditional wired lines are impractical, necessitating the use of microwave transmission. Media Links' successful demonstration paves the way for the deployment of STL transmission using the IP/PTP transmission method to broadcast stations not only in Japan but also across the globe.

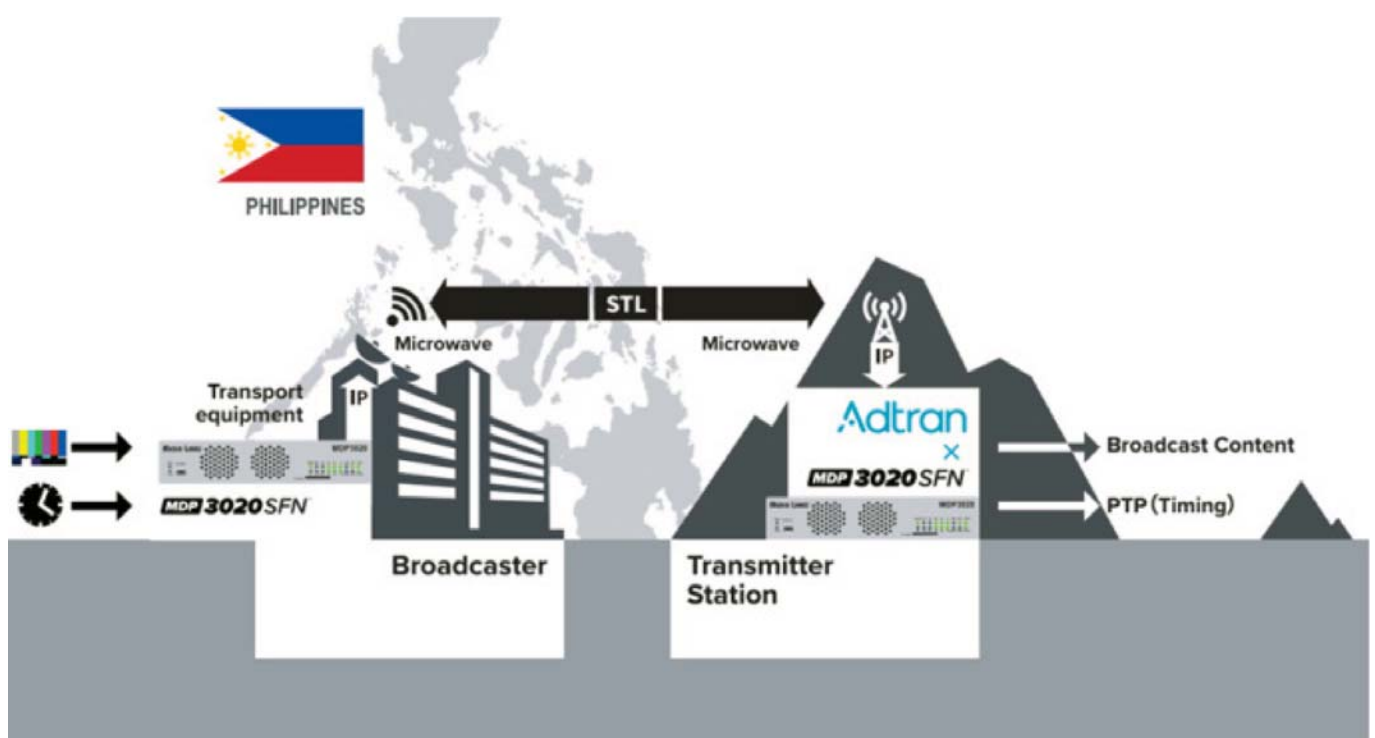
The demonstration, conducted in partnership with Oscilloquartz, took place at a broadcasting station in the Philippines from May 13 to 17, 2024. The team utilized Media Links' STL over IP/PTP device, the MDP3020 SFN, to transmit both broadcast content and PTP timing, leveraging the existing equipment installed by the broadcast station for normal microwave transmit and receive operations. The successful operation of the transmission of signals and the accurate transmission of timing by PTP reaffirmed the feasibility of realizing the world's first STL using IP and PTP over microwave lines.

Tsukasa Sugawara, the CEO of Media Links, emphasized the significance of this milestone as it opens up possibilities for STL transmission by IP/PTP over microwave lines, addressing a critical challenge in the IP migration of broadcaster systems. Furthermore, Anil K. Reddy, Associate Vice President of Oscilloquartz at Adtran Networks, expressed enthusiasm for the successful trial of PTP over IP Microwave networks with OSA Synchronization technology, highlighting the potential to enhance timing accuracy in packet broadcast networks on both wired and wireless platforms. This progressive development signals a leap forward in the evolution of broadcast technology, promising enhanced reliability and quality of experience for viewers. [\[Content+Technology\]](#)

GENAI TO BOOST DEMAND FOR HYBRID DATA PLATFORMS

A new report from Information Services Group (ISG) reveals that the adoption of AI applications, especially those powered by Generative AI (GenAI), will significantly increase the demand for platforms capable of supporting both operational and analytical processing in the next three years. This trend is vital for streaming media providers and media companies aiming to deliver personalized experiences through intelligent applications.

By the end of 2027, the development of these applications



will heighten the need for hybrid data platforms. Despite this growing demand, specialized analytic and operational data platforms will still play a crucial role, supporting real-time analytics and operational processing for various intelligent applications.

Matt Aslett, Director of Analytics and Data Research at ISG, emphasized the significance of advanced data platforms in supporting operational and analytic workloads, driven by increased AI investment. While data-driven companies are still utilizing specialized platforms for offline model training, but there is an increasing demand for real-time AI inferencing capabilities.

The report also notes that the integration of GenAI capabilities by data platform providers is still in its early stages. Among over 40 providers evaluated, only about a quarter have fully developed digital assistant capabilities for natural language database queries, while others are in preview or development stages.

Data platforms are essential for managing and analyzing enterprise data, supporting both operational and analytic applications. They are complemented by data operations and intelligence tools that facilitate agile development and enhance data understanding. [\[TV Tech\]](#)

DNEG AND DIMENSION STUDIO LAUNCH DNEG 360 VIRTUAL PRODUCTION SERVICES

DNEG, a prominent visual entertainment services company known for its collaborations with directors like Denis Villeneuve and Christopher Nolan, has launched a new division called DNEG 360, operated by Dimension Studio, a leader in real-time production. This launch includes the debut of two of the world's largest LED volume stages in London and Rome and a behind-the-scenes video titled 'The Evolution of Virtual Production' showcasing the latest virtual production techniques.

DNEG and Dimension initially formed a joint venture in February 2021 to provide virtual production services. The newly launched DNEG 360 expands this partnership to offer Visualization, Virtual Production, Content Creation, and Development services. This comprehensive service provides clients with an end-to-end production solution, ensuring a smooth transition from development and pre-production to virtual production, visual effects, and post-production for various projects, including feature films, episodic series, advertising, and music videos.

The London studio features two stages: Stage One, includes a 20m x 8m curved LED wall made up of 1,600 panels, four wild walls, and a retractable LED ceiling. Stage Two is specifically designed for performance, vehicle, and volumetric capture. The Rome studio at Cinecittà Studios includes a 24m x 8m LED volume with an LED ceiling and a 25m rotating platform deck for quick set repositioning.

Steve Griffith, Managing Director of DNEG 360 and Dimension Studio, emphasized that DNEG 360 is the only real-time powered service provider operating at such a global scale. The team's extensive experience, including over 800 virtual production shoot days, has refined their

approach, enabling them to offer valuable guidance and cost efficiencies for clients throughout the filmmaking process.

Since 2021, DNEG and Dimension have delivered virtual production work on shows such as Masters of the Air (Apple TV+), Those About To Die (Peacock), Here (Sony Pictures), Avatar: The Last Airbender (Netflix), No Way Up (Altitude Film Entertainment), Devotion (Sony Pictures), The Muppets Mayhem (Disney+), and many others.

DNEG Global CEO Namit Malhotra highlighted that the launch of DNEG 360 aligns with DNEG's strategy of investing in technological advancements to maintain its leadership position. He expressed excitement about the innovative work being done by the DNEG 360 team and welcomed clients to explore the state-of-the-art LED volume stages in London and Rome. [\[Content+Technology\]](#)

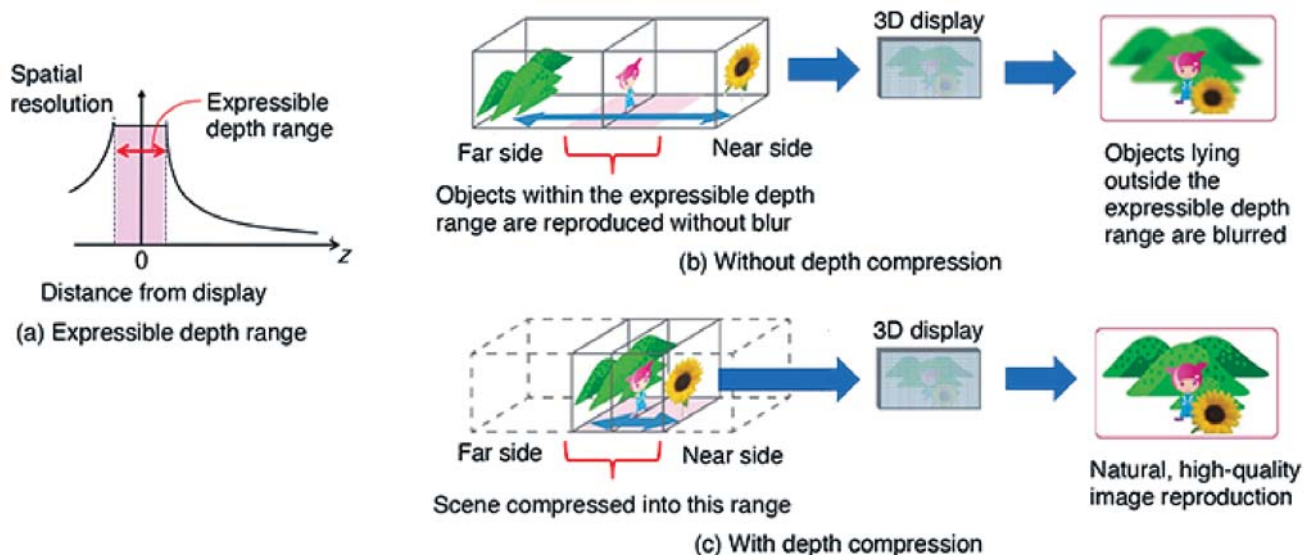
RECENT PROCESS IN COGNITIVE-SCIENCE RESEARCH WITH APPLICATIONS TO IMMERSIVE MEDIA

NHK STRL is actively engaged in R&D to create immersive media using three-dimensional AR and VR technology. The aim is to deliver new sensory experiences through immersive media while ensuring these experiences are safe and effective for human audiences. This requires the development of display devices and content-production techniques grounded in an understanding of human sensation, perception, and cognition. Modern cognitive science, which encompasses basic sensory, perceptive, and cognitive mechanisms, as well as experimental methods and psychological measurement techniques, is essential in developing this understanding. This article surveys cognitive science research relevant to immersive media, focusing on recent progress in characterizing immersive experiences, the impact of immersive media, ergonomics, and expressive techniques.

Immersive media refers to technology capable of delivering all-encompassing experiences that make participants feel as if they are plunged into entirely new worlds. The term "immersive media" broadly includes virtual reality (VR), augmented reality (AR), and mixed reality (MR). Though definitions vary slightly, there is a consensus that these technologies enable immersive experiences by immersing people within an environment. A closely related term is "sense of presence", which describes the sensation of being in a virtual environment. This article surveys cognitive science research on immersive media, focusing on methods for characterizing immersive sensations, enhancing the sense of immersion, addressing ergonomic issues, and exploring new expressive techniques.

Methods for Characterizing Immersive Sensations

To determine whether immersive media can deliver immersive experiences, researchers often use questionnaires to ask users about their sensations. The most widely used questionnaire is that of Witmer and Singer, who define presence as "the subjective experience of being in one place or environment, even when one is physically situated in another". They developed the Presence Questionnaire (PQ) and the Immersive Tendency Questionnaire (ITQ) to measure these sensations. However,



subjective reports based on questionnaires can incorporate various biases. Some studies have sought to avoid this difficulty by measuring physiological indices such as brain waves or skin conductance responses, although the relationship between these indicators and subjective reports is not always clear.

Enhancing the Impact of Immersive Media

Enhancing immersive sensations can have several advantages. For instance, stronger experiences of presence have been shown to improve the effectiveness of training in VR environments. However, these enhanced sensations can also lead to unpleasant experiences and even motion sickness. 3D content, which exploits human binocular disparity, has been shown to significantly impact perception and cognition, particularly in tasks involving spatial information and object manipulation. Studies have demonstrated that 3D information can shift perceptions and enhance learning, especially for participants with lower spatial ability.

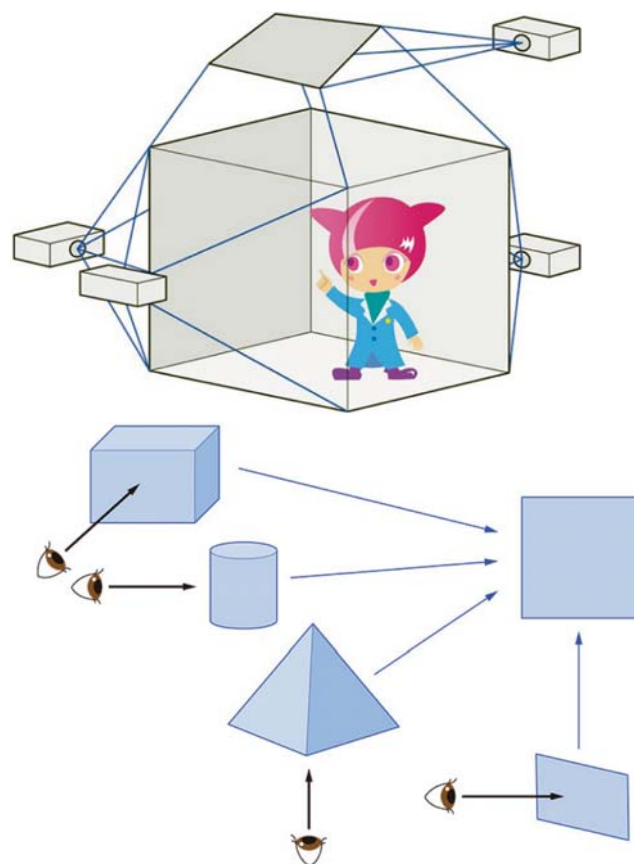
The Ergonomics of Immersive Media

Stereoscopic displays are common devices used to present immersive media. These displays can cause discomfort or fatigue due to conflicts between accommodation (focusing) and vergence (eye alignment), excessive binocular disparity, and other factors. Light-field displays, which reconstruct spatial imaging, can reduce these issues by eliminating the conflict between accommodation and vergence. However, head-mounted displays (HMDs), another common device for delivering immersive content, can cause visual fatigue and discomfort. Recent improvements in HMD performance have reduced these issues, but a comprehensive solution has yet to be found.

Expressive Techniques for Immersive Media

Immersive media requires new forms of expression to exploit the capabilities of advanced display devices. Light-field displays, for example, offer advantages such as not requiring special glasses and allowing consistent expression of depth. Techniques like depth compression have been developed to enhance the range of depths that can be expressed without degrading picture quality. HMDs, which synchronize display updates with head movements, also

require new expressive techniques to manage perceptions of distance and size. Studies have shown that users tend to underestimate distances in virtual environments, highlighting the need for optimized display strategies.



Immersive media has the potential to offer new sensory experiences, but achieving this potential requires new techniques at all stages of the media lifecycle, from content production to content viewing. Insights from cognitive science are invaluable in developing these techniques and devices. This article has discussed how these insights, combined with knowledge from computational and information science, have led to new techniques beneficial for engineering applications. Progress in immersive media depends on interdisciplinary collaboration and technological fusion, with cognitive science providing crucial inspiration for future developments. [\[NHK STRL\]](#)

DRM DIGITAL RADIO GENERAL ASSEMBLY – EXCITING DEVELOPMENTS DEFINE SUCCESSFUL EVENT

The DRM General Assembly 2024 was held for the first time in Dubai, marking a historic meeting point for members from Europe, the Middle East, India, China, Indonesia, Canada, and various virtual guests from regions including South Africa, Myanmar, and Australia. The assembly showcased significant advancements in DRM technology, with a particular focus on developments in India, Indonesia, Pakistan, South Africa, and China.

Key discussions included the status of digitization in India, where government decisions on FM digitization are anticipated, and a comprehensive presentation from Indonesia's ministerial representative on the country's adoption of a dual open standards solution. A noteworthy document from China's National Radio and Television Administration, Ministry of Industry and Information Technology, and State Administration for Market Regulation was reintroduced, emphasizing the promotion of DRM implementation in car manufacturing in China. The CCBN Broadcasting Professional Exhibition in April 2024 also highlighted China's interest in in-car digital radio solutions, with prominent companies like NXP, Nautel, Fraunhofer IIS, and others showcasing their innovations both at CCBN and in Dubai.

The most eagerly awaited session was on receivers, featuring contributions from companies such as CML Micro and Cambridge Consultants (UK), BBC, Gospell (China), Starwaves (Switzerland), and others. This session covered a wide range of products, including chipsets, modules, professional receivers, standalone radios, car receivers, public announcement systems, and monitoring receivers. A highlight was the announcement of the DRM1000 module by CML Micro and Cambridge Consultants, aimed at enabling low-cost, low-power DRM radio designs for consumer manufacturers.

The assembly concluded with updates on geographic and receiver developments, news from both new and established companies and strategic discussions shaping the direction of DRM activities for 2024-2025. Ruxandra Obreja, the re-elected chairman of the DRM Consortium, praised the event for its global reach and the palpable interest in DRM, emphasizing the comprehensive solutions available for DRM receivers across various platforms and standards. [\[DRM\]](#)

A CONVENIENT ALTERNATIVE TO THE 'GPT-FOR-ALL' APPROACH

Today, many AI applications heavily rely on proprietary Large Language Models (LLMs). However, this reliance may not always be optimal. LLMs are classified into two main categories: free community models like Llama, Mistral, and Falcon, and proprietary models such as ChatGPT, Google Gemini, and Claude, usually accessed through paid services. Proprietary models, developed with extensive reinforcement learning from human feedback, are often the most powerful but entail substantial costs, including computing fees and environmental impacts, which could potentially become unsustainable for businesses and society.

At Rai's R&D center, CRITS, experiments are being conducted to determine if smaller, simpler models can perform as effectively as proprietary ones without significant performance loss. Presented at the EBU DataTech Seminar 2024, the research showed that fine-tuned models might be more effective for specific, well-defined tasks.

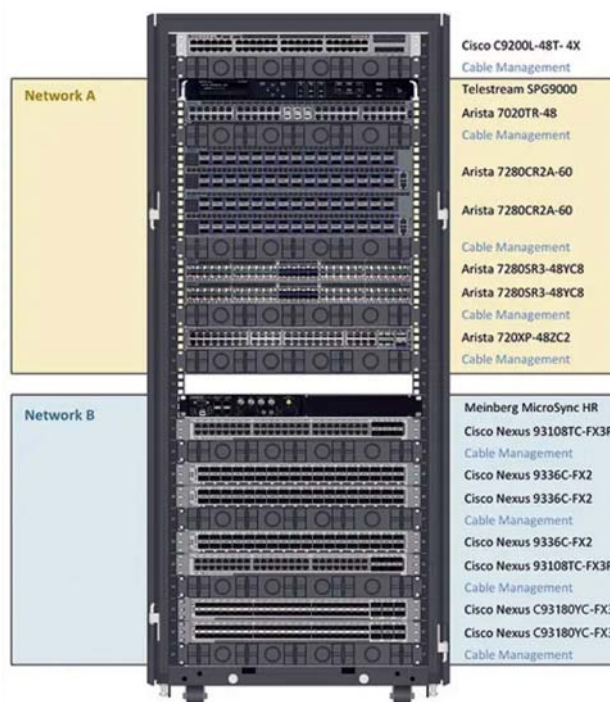
CRITS developed datasets to fine-tune a Large Language Model (LLM) for three media-related tasks: suggesting news article titles, generating semantic tags, and detecting topic changes in text. These datasets were compiled from Rai news websites. The selected model for fine-tuning was Llamantino 7B, a refined version of Meta's Llama2 optimized for Italian by the University of Bari. The fine-tuning process utilized the LoRA technique, which demands fewer computational resources.

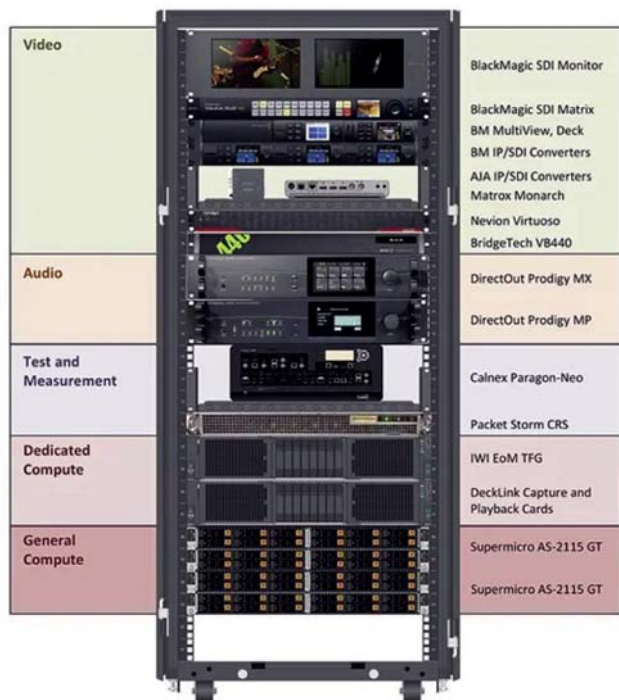
Benchmarking the fine-tuned models against GPT-4 on Rai-produced news articles and a custom-labeled dataset for topic change detection showed promising results. The fine-tuned models' performance was closer to the ground truth for all tasks compared to GPT-4, suggesting that in specific contexts, smaller, fine-tuned models could be more effective and cost-efficient alternatives to proprietary LLMs. [\[EBU News\]](#)

EBU LAUNCHES LIVE IP MEDIA SANDBOX TO BRIDGE SKILL GAP IN IP-BASED MEDIA PRODUCTION

EBU Members considering transitioning to IP-based production infrastructure will soon have access to a new resource: the EBU's Live IP Media Sandbox. This IP-based media production facility is designed to help Members gain both theoretical and practical knowledge, with a strong emphasis on hands-on experience, addressing the skill gap in IP-based media production.

The Live IP Media Sandbox, contained in two flight racks, serves as an educational tool and a pre-built proof of concept (PoC) for members planning their first IP-based projects. By offering two alternatives for most system





components, it enables members to evaluate different options and make informed procurement decisions.

The racks can be shipped to members' premises, where EBU experts will offer on-site guidance and training for about a week. Following this initial training, the racks remain on-site for an extended period, typically a month, allowing staff to gain practical experience.

Additionally, the EBU Academy supports this transition with dedicated training courses, such as "Preparing Your Move to Live IP Production" and "Live IP Essentials", available online and on-demand to complement the Live IP Sandbox experience. [\[EBU News\]](#)

ITU HELPS COUNTRIES ACHIEVE ROBUST RADIO FREQUENCY PLANNING

The radio spectrum is crucial for various technologies, from mobile communications and broadcasting to navigation and satellite services, forming the backbone of modern society. Effective management and planning of radio frequencies are essential to ensure seamless operations and equitable sharing of this limited resource globally.

To assist radiocommunications regulators, the International Telecommunication Union (ITU) conducted a series of regional workshops to help administrations update or develop their National Tables of Frequency Allocation (NTFAs) based on the latest 2024 Radio Regulations. NTFAs are critical documents that outline the planned uses and allocations of spectrum within each country's regulatory framework, ensuring efficient use and preventing interference between different radio communication systems.

Mario Maniewicz, Director of the ITU Radiocommunication Bureau, emphasizes that regularly updating NTFAs is vital for national spectrum management and alignment with international regulations. These updates help prevent

harmful interference with other countries' radio systems and accommodate new radio technologies.

The ITU workshops provided comprehensive training on spectrum management and software tools, addressing common challenges faced by countries, such as limited awareness and resources. The workshops were held in Addis Ababa for Region 1 (Africa, Europe, and the Middle East), Mexico City for Region 2 (the Americas), and Shenzhen for Region 3 (Asia-Pacific and Oceania).

Frequency planning not only supports existing and new radio systems but also stimulates economic growth by enabling telecommunications and broadcasting industries to operate and expand efficiently. Maniewicz highlights that efficient spectrum use fosters innovation, drives productivity, and creates new market opportunities, reinforcing the importance of robust frequency planning and global collaboration. [\[ITU News\]](#)

PRASAR BHARATI TO LAUNCH ITS OWN OTT PLATFORM FOR SAFER CONTENT

Prasar Bharati is set to launch its own over-the-top (OTT) platform in August, marking a significant step in India's digital broadcasting landscape. This platform will primarily focus on streaming family-friendly content that promotes Indian values, culture, and knowledge. In an effort to provide widespread access, the platform will be available for free for several years, ensuring that viewers from all walks of life can benefit from its offerings.

The new OTT platform will feature a diverse range of content, including informative programs, current affairs, and entertainment. Notable content providers such as Sri Adhikari Brothers, acclaimed actor Kabir Bedi, and renowned filmmaker Vipul Amrutlal Shah will contribute to the platform, bringing high-quality and engaging content to audiences. This initiative aims to cater to the varied tastes and preferences of viewers while maintaining a focus on educational and culturally enriching material.

The Indian government's journey towards launching this platform began in September of last year with the release of a tender seeking expertise in designing, developing, commissioning, operating, and maintaining the OTT platform. The primary objective is to ensure that the platform reaches even the remotest villages of India, bridging the digital divide and ensuring that no one is left behind in accessing quality content.

This action is a response to increasing concerns about the nature of content available on some existing OTT platforms. In May of last year, the Indian government advised platforms such as Prime Video and Netflix to refrain from streaming content that was considered 'abusive and vulgar'. Furthermore, earlier this year, the Ministry of Information and Broadcasting took firm action by blocking approximately 18 OTT platforms and associated social media accounts for broadcasting material deemed 'vulgar and obscene'.

By launching its own OTT platform, Prasar Bharati aims to set a new standard for digital content in India, prioritizing

family-friendly and culturally significant programming. This initiative underscores the government's commitment to fostering a digital environment that is both informative and respectful of Indian values, while also embracing the potential of modern technology to reach and educate a wide audience. [\[ABU News\]](#)

COST-EFFECTIVE STREAMING: SAVE MONEY WHILE MAXIMISING PERFORMANCE TO SURVIVE & THRIVE

The demand for video content has seen a significant increase globally, primarily because of the shift from traditional broadcasting to streaming. This shift has put companies under pressure to provide more content to a broader audience, including live streaming and ultra-high definition (UHD) content, all while upholding quality and handling escalating delivery costs.

John Wastcoat, Senior Vice-President of Business Development and Marketing at Zixi, points out that traditional methods such as satellite and next-generation IP and cloud deployments come with substantial expenses. Similarly, Paul Calleja, CEO of GlobalM, notes that the cost of GEO satellite capacity is on the rise as the industry shifts focus to data and LEO networks.

The increasing scarcity and cost of engineering talent are also raising human resource costs, a trend expected to continue. Delivery costs are projected to increase by up to 42% over the next five years. Consequently, efficient and cost-effective delivery solutions are vital.

Elodie Levrel, Corporate Marketing & Communications Director at Broadpeak, suggests that smart technologies can help businesses reduce infrastructure investments while optimizing video delivery. Broadpeak identifies four pillars to reduce streaming costs: using existing CDN infrastructure, optimizing streaming performance to reduce server and power consumption, leveraging cloud technology for efficient cache deployment, and using multicast adaptive bit rate (MABR) for live event delivery.

Other companies, such as Harmonic, are incorporating AI and ML technologies to enhance encoding efficiency and reduce bandwidth usage. Harmonic's AI-driven PURE compression engine supports various video coding (VVC), resulting in substantial bandwidth savings. Zixi utilizes AI and ML for monitoring and fault analysis, leading to reduced operational costs and improved resource allocation.

GlobalM is leveraging low-cost public internet links and software-defined video networks to offer high-quality video transport services at a lower cost than traditional methods. This technology has global scalability, utilizing geolocated network resources and open standards to further reduce expenses.

Overall, reducing video delivery costs is crucial for maintaining competitiveness in the streaming industry. Companies must adopt efficient distribution strategies and technologies to streamline operations, improve performance, and achieve long-term sustainability. This includes optimizing resource allocation, reducing energy consumption, and enhancing the user experience while navigating the rapidly

evolving landscape of video delivery. [\[APB News\]](#)

ATSC 3.0 DATACASTING COMES OF AGE

The 2024 NAB Show proved to be a watershed moment for the evolution of ATSC 3.0-based datacasting, positioning it as a viable revenue-generating opportunity in the broadcast industry. Sinclair Broadcast Group made a significant stride with the launch of its Broadspan datacasting platform, designed to facilitate the distribution of data over ATSC 3.0 to diverse consumer devices. Chris Ripley, CEO of Sinclair, underscored the platform's capabilities during the company's press conference, emphasizing its ability to provide comprehensive insights into network availability and tailored data delivery paths. Initially rolled out across Sinclair's 30-plus markets where it acts as the 3.0 host station, Broadspan immediately attracted interest from Edgio, a content delivery network planning to leverage the platform to enhance OTT streaming services with over-the-air 4K video delivery.

Ripley addressed concerns about bandwidth limitations by highlighting the unique coverage potential of Sinclair's 3.0 infrastructure, which spans broad geographic areas. This contrasts favorably with traditional broadband metrics. This strategic deployment positions Sinclair not only as an innovator in datacasting but also as a pioneer in maximizing the spectrum potential of ATSC 3.0 for enhanced service delivery.

Simultaneously, AT&T Business made headlines at the NAB Show by announcing its entry into the Advanced Television Systems Committee (ATSC), signaling its intent to explore ATSC 3.0 as a robust solution for wireless data delivery. The company unveiled plans for a forthcoming pilot program deploying ATSC 3.0 OTA datacasting via Caros>>I receivers for digital signage applications in its retail locations. This initiative represents a bold step towards commercializing 3.0 datacasting services by the end of 2024, positioning AT&T Business at the forefront of leveraging broadcast technology for enterprise solutions.

Further amplifying the momentum for ATSC 3.0, Peak3 emerged as a significant player in the ecosystem, securing strategic partnerships with Sinclair and OTA Wireless to expand its footprint in IoT data solutions. Alp Sezen, CEO of Peak3, highlighted their innovative approach to overcoming pricing challenges associated with 3.0 bandwidth, negotiating revenue-sharing agreements with broadcasters to optimize the economic value of datacasting services. This approach ensures competitive pricing while fostering collaborative growth in the evolving broadcast landscape.

These developments highlight the increasing agreement within the industry about the transformative potential of ATSC 3.0 datacasting. Beyond technical feasibility, the focus has shifted towards utilizing this technology to unlock new revenue streams and improve service offerings across various market segments. Moving forward, stakeholders expect further progress in NextGen TV, including talks about phasing out legacy ATSC 1.0 infrastructure, which will pave the way for wider adoption and innovation in broadcast technology. [\[ATSC\]](#) ■

Equipment Trends

AJA KI PRO GO2



Next Generation Digital Recorder featuring HEVC
AJA Video Systems introduced the Ki Pro Go2, the latest iteration of its multi-channel HD/SD recorder, Ki Pro Go. This portable, 2RU device offers an enhanced feature set, supporting up to four channels of simultaneous H.265 (HEVC) or H.264 (AVC) recording. It provides cost-efficient recording to USB 3.0 drives or network storage, with options for redundant recording and single-channel playback. The Ki Pro Go2 is designed to deliver higher quality images at lower bit rates, enabling extended recording times.

The device features flexible connectivity options, including four 3G-SDI and four HDMI digital video inputs, accommodating a wide range of video sources. According to AJA's President, the Ki Pro Go2 was developed with versatility in mind, catering to diverse production scenarios. It integrates user feedback from various regions where H.265 is extensively utilized, offering the flexibility to record in either H.265 or H.264 formats.

The Ki Pro Go2 is suited for a variety of environments, including live events, educational settings, and more. It simplifies setup and operation with an HD display for accurate monitoring, video and status overlays, and an intuitive web-based user interface accessible from any web browser. Key operational features include integrated input frame synchronizers, high-quality de-interlacers, multi-channel matrix monitoring, and versatile audio functionality supporting up to two channels of embedded or analogue audio input, including support for LTC.

The device supports convenient and cost-effective recording to USB media and network storage, compatible with FAT and exFAT file systems for cross-platform compatibility. Multi-channel recording allows for separate file management for each input, with logical clip naming and easy file transfer to creative software. Additional features include enhanced Super Out for timecode and media status monitoring, and support for playback of HEVC/AVC files from popular creative applications.

The Ki Pro Go2 offers multi-channel HD/SD recording, intuitive operation via a web UI and front panel controls, flexible connectivity, and a range of monitoring and recording features. It is backed by a three-year warranty and AJA's renowned support.

<https://www.aja.com/products/ki-pro-go2>

OCONNOR 2575E PLATINUM

Fluid Head

Founded in 1949 by Chadwell O'Connor, OConnor has been a pioneer in the camera support industry, known for its innovation and craftsmanship. The company gained early recognition with the development of the first fluid-damped camera head, designed to provide smoother camera movements, particularly for filming steam trains. This innovation caught the eye of Walt Disney, leading to a collaboration that helped establish OConnor's esteemed reputation.





The latest model, the 2575E, continues this legacy of innovation. It features OConnor's patented sinusoidal counterbalance system, which ensures precise balance throughout the tilt range. The head also includes stepless, ultra-smooth pan and tilt fluid drag with infinite drag adjustment, allowing for both rapid whip pans and smooth, precise long lens framing, making it ideal for a wide range of cinematic applications.

The 2575E features OConnor's patented sinusoidal counterbalance system, providing precise and accurate balance throughout the tilt range. Paired with OConnor's stepless, ultra-smooth pan and tilt fluid drag, this system offers ultimate control and stability for cinematic shooting.

Classic Features:

- **Payload Range:** Supports loads ranging from 0 to 105 lbs (0 to 47.7 kg) with a center of gravity height of 6 inches above the platform.
- **Counterbalance Crank:** Equipped with a numerical readout for precise adjustments.
- **Operator-Friendly Controls:** Strategically placed on the operator's side for ease of use.
- **Versatile Platform:** Includes four handle rosettes for various configurations.
- **Soft Hand Rest:** Positioned on the left-hand side for added comfort.

Platinum Edition Updates:

- **Stainless Steel Center Lock:** Securely holds in both on and off positions.
- **New Platform Release Mechanism:** Allows for fore and aft adjustments with single-handed operation.
- **Lightweight Carbon Fiber Cover:** Replaces the traditional plastic cover, enhancing the balance mechanism.
- **Improved Level Bubble Illumination:** Ensures visibility in any setup position.
- **Clear Mitchell Key Position Marker:** Streamlines the setup process.
- **Fresh Design:** Features a modern gray colourway with black detailing.

The Platinum 2575E's infinite drag adjustment capabilities accommodate everything from rapid whip pans to precise long lens framing. Its lightweight magnesium housing offers best-in-class performance, power-to-weight ratio, and reliability. True to its renowned legacy, the Platinum 2575E is a versatile and dependable fluid head, ready to support your most ambitious productions.

<https://www.ocon.com/products/fluid-heads/ultimate-2575e/>

SHURE WL18XM



Professional Lavalier Condenser Microphones

Shure has unveiled its newly redesigned WL18Xm series of low-profile professional lavalier condenser microphones. This updated series includes the cardioid WL185m, supercardioid WL184m, and omnidirectional WL183m models, all tailored for use with wireless bodypack transmitters.

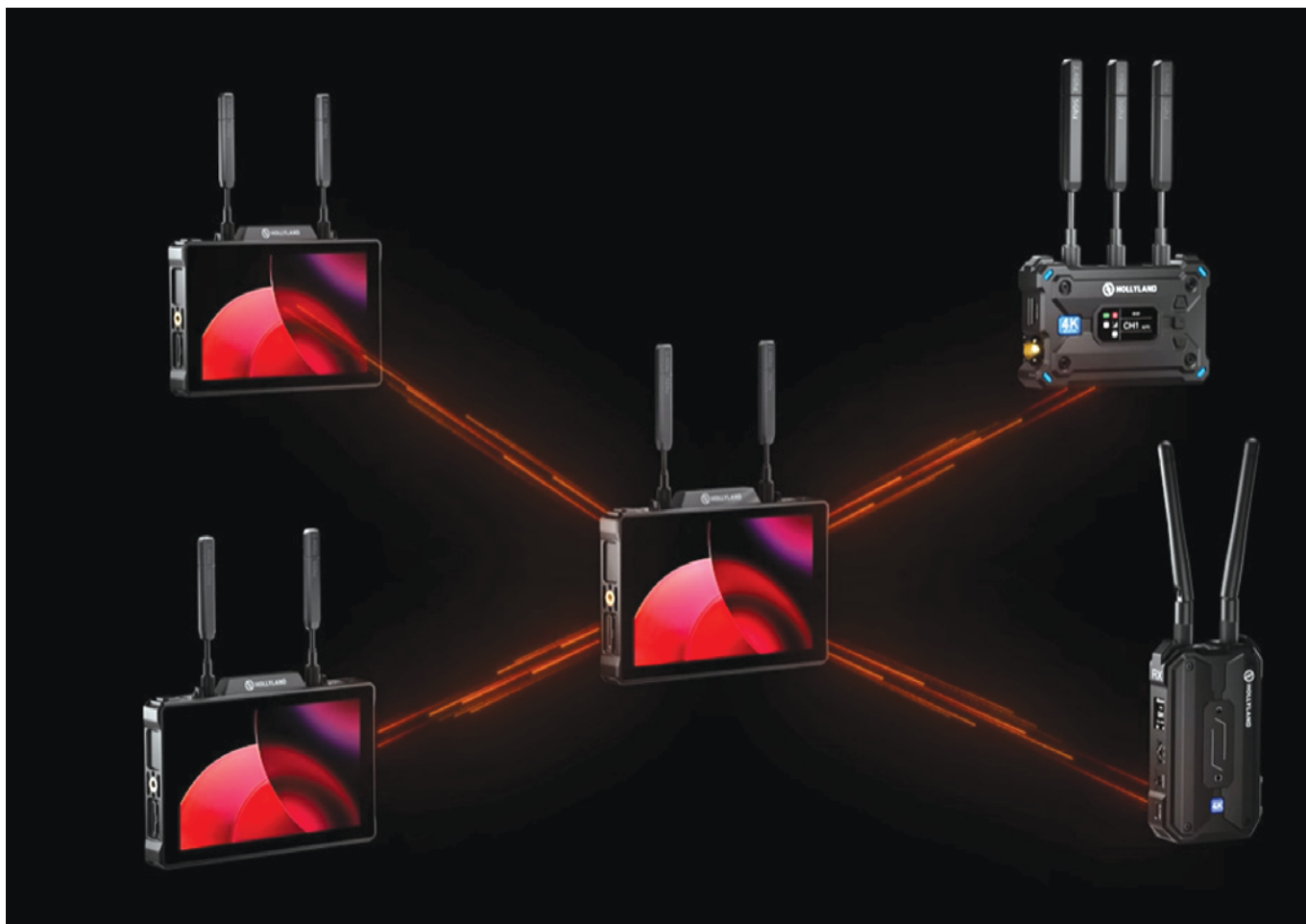
Building on the legacy and proven performance of Shure's existing WL lavalier microphones, the WL18Xm series offers enhanced sound quality with an improved presence response. These microphones are engineered to provide full and accurate audio reproduction, making them ideal for speech and presentation applications in corporate, educational, and worship settings. The new design features improved specifications, ensuring optimal compatibility with modern wireless systems and delivering superior performance in terms of sound clarity and reliability.

The WL18Xm microphones are designed to meet the evolving needs of professionals in the field of digital audio systems. The updated line boasts lower self-noise, improved RF immunity, a higher dynamic range, and an increased maximum sound pressure level (SPL). These enhancements ensure that the microphones can handle a wide range of audio environments and requirements, providing clear and precise audio capture.

The new WL18Xm models are 8 mm shorter than their predecessors, making them more lightweight and unobtrusive. This low-profile design makes the microphones easier to conceal and more comfortable for speakers, presenters, and performers. Available in both black and white, with options for LEMO or TA4F connectors, these microphones offer flexibility in placement and integration with various systems. The innovative tie clip, which can be rotated in 90° intervals, allows for precise positioning, ensuring optimal audio pickup in any scenario.

The refreshed WL18Xm series reflects Shure's commitment to innovation and excellence in audio technology, providing professionals with reliable, high-quality solutions that cater to the demands of modern wireless communication environments.

<https://www.shure.com/>



HOLLYLAND PYRO 7

All-in-one video monitor

Introducing the Pyro 7, a wireless video monitor that integrates TX, RX, and a seven-inch monitor screen into a single, compact, lightweight, and robust device. The Pyro 7's Auto Dual-Band Hopping (ADH) technology resists interference and supports a long operational range of up to 1,300ft (400m). With a low latency of only 60ms, it provides smooth and responsive video monitoring for professional-level teams and creators.

The Pyro 7 offers a comprehensive, compact monitoring and transmission solution as part of the new Pyro Series, which includes the Pyro S and Pyro H. Exceptional hardware design allows the Pyro 7 to connect one transmitter to four receivers simultaneously, and customizable shortcut keys provide the convenience of dual-camera monitoring. The upgraded HollyOS offers enhanced image analysis capabilities and allows for bulk video file export via SD card.

The new Pyro series features revolutionary devices for transmitting and monitoring video, reshaping the way users capture footage. A single Pyro transmitter can send clear, near real-time video to up to four receivers at once, enabling all crew members to monitor live video simultaneously.

With Auto Dual-Band Hopping (ADH) technology, Pyro operates on both 2.4 GHz and 5 GHz bands with intelligent Auto Frequency Hopping. This series is the

perfect solution for multi-user monitoring in dynamic shooting scenarios, such as film production, live events, and ENG/EFP applications. Pyro enhances collaboration and productivity on every shoot.

Pyro H, S, and 7 are compatible with each other, each offering unique features to suit user requirements. The Pyro H transmitter includes HDMI input and loopout, enabling connection to a camera for sending video to other receivers while monitoring from the loopout port to an external screen. Pyro S, equipped with HDMI and SDI ports, is suitable for professional shooting and smaller commercial projects. Pyro 7, featuring a built-in seven-inch monitor, supports both HDMI and SDI input, output, and loopout, allowing users to choose connections based on their shooting needs and equipment.

Pyro 7 facilitates seamless connection with Pyro H and Pyro S after a grouping preset is engaged. Users can monitor different camera views on Pyro 7 by swiftly switching between them with customizable buttons.

With WifiBroadcast technology, Pyro 7 enables one transmitter to provide a stable signal to four receivers simultaneously, offering more flexibility and faster decision-making when the team and clients require additional monitoring on set.

<https://www.hollyland.com/>



MPMC SUPER MILO

Robotic arm system with motion control

Introducing the Super Milo, where macro precision meets high speed. Set to launch soon, the Super Milo promises unparalleled, repeatable camera movements, revolutionizing visual effects creation and solidifying its place as an essential tool for modern cinematographers.

Building on the legacy of its award-winning predecessor, the Super Milo significantly enhances speed, acceleration, reach, and quick assembly. Achieving speeds of up to 3 m/s on track and 5 m/s with combined camera movement, it is designed for high-speed filming. Equipped with state-of-the-art brushless motors, it reaches speeds up to 100% faster and accelerations up to 400% quicker than the original version. The rig can accommodate a camera payload of 35kg.

The Super Milo's geometry allows for smooth, stable movements from below ground level to a maximum height of 6.1 meters. With easy-to-fit extensions, it offers flexible shooting configurations. Electronic lifting actuators expedite track setup, making the Super Milo a high-precision, high-speed rig suitable for macro, tabletop, CGI work, and high-speed live-action shooting. Setup takes under an hour, facilitated by an electric jacking system that speeds up rail assembly.

The success of the original model paved the way for other motion control systems, but it remains a benchmark in the industry due to its unparalleled stability, reliability, and

quality of results. The Super Milo continues to provide an example of excellence in cinematography, demonstrating the latest advancements in macro and high-speed robotic camera technology.

<https://www.mrmoco.com/motion-control/super-milo/>

ANTON BAUER VCLX LI 1600WH

Multi-voltage battery

A leading provider of mobile power systems for the film and television industry has introduced the VCLX LI 1600, the latest evolution in its award-winning VCLX range of block battery systems. This new model delivers more power than ever from a lightweight, IP65-rated weatherproof unit.

The VCLX LI is a 1600Wh capacity battery, offering more than double the power of its predecessor while being lighter at just 25.5 lbs. It provides multi-voltage output (14.4V, 28V, and 48V) through two XLR4 outputs and one XLR3, seamlessly powering cameras, monitors, and lighting equipment. For example, an ARRI ALEXA 35 rig requiring approximately 300 watts at 28V DC can be powered for 5.3 hours by the VCLX LI, supporting both the camera and additional equipment such as a monitor, wireless transmitter, wireless focus lens motors and receiver, focus assist, and lens light.

The VCLX LI 1600 is engineered for durability with a rugged anodized aluminum chassis, over-molded end caps, and handle grips. Its IP65-rated weatherproof case



ensures reliable performance in any environment, while passive cooling technology eliminates fan noise for silent operation. A 2.4" color LCD screen provides real-time monitoring of remaining runtime, charge time, and active power draw. Built-in smart technology offers real-time onboard diagnostics, ensuring maximum power efficiency and performance. The intelligent system calculates and displays power requirements from devices connected to the XLR3, XLR4, or USB ports.

Designed without an internal charger to minimize heat buildup, the VCLX LI extends the battery cells' lifespan and eliminates noisy cooling fans. An external charger reduces the risk of unit failure due to component malfunction, maximizing investment longevity and equipment uptime.

VCLX units also come with built-in fleet management capabilities, allowing users to download vital information via WiFi or USB. The comprehensive fleet management software provides insights into the battery's learned capacity, cycle count, charge percentage, and error history, enabling efficient triage and rectification. This ensures more time on set and less time in the workshop.

<https://www.antonbauer.com/en/product/vclx-li-1600/> ■

How to contribute to the Technical Review

Would you like to contribute an article to the ABU Technical Review?
We welcome submissions from everyone. This is an excellent opportunity to showcase your organisation's work and gain significant exposure.

We are open to a variety of articles, including research papers, details on new technical developments, or any content that will interest TR readers. The Technical Review, our quarterly publication, is distributed to all ABU members, industry partners, and technical staff, as well as international organisations such as the ITU, other broadcasting associations, and universities.

While it primarily targets engineers, it also features general interest news stories. It contains articles on new technologies, developments in broadcasting, member innovations, and other materials of interest to engineers.

Your article can be of any length and written in any style. Should you include photos, please ensure they are high resolution (at least 2 megapixels). Although we cannot offer payment, we do provide a free half-page advertisement for select articles, especially those covering technical research. This advertisement will be placed immediately after your article, giving your organisation extra publicity.

Additionally, articles by ABU members on Case Studies, Research, and Practical Implementations are eligible for the annual ABU Technical Review Prizes, which include a cash prize and a certificate.



You can view previous issues of the Technical Review on the ABU website's main page or directly at: <https://www.abu.org.my/technical-review/>

We look forward to considering your submission. If you need more information, please contact: balqis@abu.org.my

Personalities & Posts

Shree's Farewell

Shree Bhadra Wagle joined ABU in 2018 and quickly became well-known among ABU members and colleagues. As the Manager of Production & Delivery Technologies, he earned a reputation for being exceptionally hardworking and dedicated. His strong work ethic and professionalism greatly contributed to the growth of the Technology Department.

Shree's efforts were instrumental in the success of numerous events, including the Digital Broadcasting Symposium and various workshops and seminars. He played a pivotal role in most of the Technical Advisory Services and was deeply involved in publications like the Technical Review. His unwavering optimism and positive attitude, regardless of the challenges, consistently motivated the team and fostered a collaborative environment.

In May 2024, Shree bid farewell to the ABU team. During his farewell, Dr Veysel, the Director of the Technology Department, expressed his sentiments, saying, "Shree's dedication and positive outlook have been a cornerstone of our department. His ability to remain optimistic and inspire those around him, even in challenging times, has been invaluable. Shree's presence brought a unique energy to our team, encouraging everyone to strive for excellence and maintain a positive spirit. His contributions have not only advanced our technological capabilities but also strengthened the camaraderie within our team".

It is with a heavy heart that we bid adieu to Shree. On behalf of everyone at ABU, we thank him for his service. Shree will be greatly missed, especially by the technology team. We wish him all the best in his future endeavours. ■

"Thank you, Shree"



New Technical Liaison Officers



Mr Sok Odom joined the Cambodian Broadcasting Service (CBS) in 2014 as a Satellite Engineer Operator and quickly advanced, serving as a Satellite Engineer Manager until 2018. Currently, he holds the position of Technical Support Manager, overseeing operations spanning control rooms, transmitter sites, satellite communications, and master control rooms.

In the area of Technical Support, Mr Odom manages and installs control rooms, addresses technical issues, and provides operational and engineering support. Within the Control Room domain, he ensures smooth operations and timely maintenance for various game show formats. Across more than 11 transmitter sites, he troubleshoots and repairs equipment, manages relay station installations, and promptly resolves operational challenges. In Satellite communications, Mr Odom excels in configuring advanced systems,

optimising signal clarity through precise antenna alignment, and overseeing the operation of C-Band and Ku-Band DSNG Vans, including encoders and decoders.

Mr Odom has led numerous high-profile projects, including the technical coordination and service provision for major sporting events such as the World Cup (2014, 2018, 2022), EURO (2016, 2020), English Premier League, Champions League, EUROPA League, La Liga, the 32nd SEA Games, and the Olympic Games.

During the COVID-19 lockdown in 2020, Mr Odom received appreciation for ensuring smooth operations under challenging conditions. In 2021, he was recognised for his efforts for the live broadcast of EURO 2020. His commitment to excellence and leadership was acknowledged with an Employee Appreciation Award in 2023. He also received the 10 Years' Service Award and the Technical Operations Team Award for outstanding production and broadcast coverage of the 32nd SEA Games and 12th ASEAN Para Games in Cambodia in 2023.

Furthering his commitment and contribution to the CBS, Mr Odom has completed training in Satellite Communication and Antenna Installation at APT Satellite Company Limited in Hong Kong and a course on Future Digital Broadcasting at the Ministry of Post and Telecom in Cambodia. ■



Dr Wilasinee Phiphitkul is the 4th Thai PBS Director General, first taking office in July 2017. She was appointed for a second term as Director General in July 2021. She received her master's degree and PhD in Women's Studies from the University of Kent in Canterbury, UK. She also received her bachelor's and master's degrees in communication arts from Chulalongkorn University.

She was a Faculty Member and Deputy Dean at the Faculty of Communication Arts, Chulalongkorn University (1993 - 2005). She switched her career field and became Senior Director of Media for Health Section at the Thai Health Promotion Foundation (2005 - 2016). She was also the Thai PBS Deputy Director General between 2016 to 2017. Dr Wilasinee specialises in strategy development, network building and mobilisation, and social advocacy. She has long been a major contributor to Thai media policy reform. ■

ABU TECHNOLOGY CALENDAR *of Events*

2024

15-19 January	HFCC A24 Conference	Kuala Lumpur
7 February	ABU-DRM Webinar on Delivering Emergency Warnings with DRM	Online
15-17 February	28 th BES Conference and Expo	New Delhi, India
4-7 March	ABU Digital Broadcasting Symposium 2024	Kuala Lumpur
9 April	Webinar Series on Member Innovations	Online
23-24 April	ABU Technical Bureau Mid-Year Meeting	Beijing, China
23-26 April	China Content Broadcasting Network show (CCBN)	Beijing, China
21-23 May	CABSAT	Dubai
21-24 May	KOBA Show	Seoul, Korea
29-31 May	BroadcastAsia 2024	Singapore
23-25 July	ABU-ASBU-WorldDAB Technical Workshop	Online
26-30 August	B24 Conference	Tashkent, Uzbekistan
September	Webinar Series on Member Innovations	Online
13-16 September	International Broadcasting Convention 2024	Amsterdam
18 October	ABU Technical Bureau Annual Meeting	Istanbul, Türkiye
19-20 October	ABU Technical Committee Meeting	Istanbul, Türkiye
22-23 October	ABU General Assembly	Istanbul, Türkiye
13-15 November	Inter BEE 2024	Japan



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