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FERGANA BRANCH OF TUIT
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# "AL-FARG'ONIY AVLODLARI"

ELEKTRON ILMIY JURNALI | ELECTRONIC SCIENTIFIC JOURNAL

# TA'LIMDAGI ILMIY, OMMABOP VA ILMIY TADQIQOT ISHLARI

4-SON 1(8)
2024-YIL

TATU, FARG'ONA
O'ZBEKISTON

ISSN 2181-4252

# O‘ZBEKISTON RESPUBLIKASI RAQAMLI TEXNOLOGIYALAR VAZIRLIGI

## MUHAMMAD AL-XORAZMIY NOMIDAGI TOSHKENT AXBOROT TEXNOLOGIYALARI UNIVERSITETI FARG‘ONA FILIALI

**Muassis:** Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti Farg‘ona filiali.
**Chop etish tili:** O‘zbek, ingliz, rus.
Jurnal texnika fanlariga ixtisoslashgan bo‘lib, barcha shu sohadagi matematika, fizika, axborot texnologiyalari yo‘nalishida maqolalar chop etib boradi.

**Учредитель:** Ферганский филиал Ташкентского университета информационных технологий имени Мухаммада ал-Хоразми.
**Язык издания:** узбекский, английский, русский.
Журнал специализируется на технических науках и публикует статьи в области математики, физики и информационных технологий.

**Founder:** Fergana branch of the Tashkent University of Information Technologies named after Muhammad al-Khorazmi.
**Language of publication:** Uzbek, English, Russian.
The magazine specializes in technical sciences and publishes articles in the field of mathematics, physics, and information technology.

**2024 yil, Tom 1, №4**
**Vol.1, Iss.4, 2024 y**

**ELEKTRON ILMIY JURNALI** **ELECTRONIC SCIENTIFIC JOURNAL**

«Al-Farg‘oniy avlodlari» («The descendants of al-Fargani», «Potomki al-Fergani») O‘zbekiston Respublikasi Prezidenti administratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligida 2022-yil 21 dekabrda 054493-son bilan ro‘yxatdan o‘tgan.

Jurnal OAK Rayosatining 2023-yil 30 sentabrdagi 343-sonli qarori bilan Texnika fanlari yo‘nalishida milliy nashrlar ro‘yxatiga kiritilgan.

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Aeroport ko‘chasi 17-uy,
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**FARG’ONA - 2024 YIL**

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**Jurnal quyidagi bazalarda indekslanadi:**



***Eslatma! Jurnal materiallari to'plamiga kiritilgan ilmiy maqolalardagi raqamlar, ma'lumotlar haqqoniyligiga va keltirilgan iqtiboslar to'g'riligiga mualliflar shaxsan javobgardirlar.***

## MUNDARIJA | ОГЛАВЛЕНИЕ | TABLE OF CONTENTS

## MUNDARIJA | ОГЛАВЛЕНИЕ | TABLE OF CONTENTS

## MUNDARIJA | ОГЛАВЛЕНИЕ | TABLE OF CONTENTS

# RESEARCH ON INCREASING THE BRIGHTNESS OF TELEVISION IMAGES

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**Abstract.** This article examines the main technologies and methods aimed at increasing the brightness of television images. It is explained that new generation display technologies such as OLED and QLED, HDR, Local Dimming, and Quantum Dot technologies are important in improving brightness and contrast. It also describes how to improve image quality by optimizing AI-based algorithms and TV settings. Through these methods, television images are ensured to be more vivid and saturated

**Keywords:** television images, brightness, OLED, QLED, HDR, Local Dimming, Quantum Dot, AI algorithms, contrast, display technologies

## INTRODUCTION

Televisions have become an integral part of modern life, and their quality is developing every year. Image quality, especially brightness, has a direct impact on audience experience. Bright images, especially in HDR technology, help make the viewing process more vivid and natural. Modern televisions, such as display technologies such as OLED and QLED, and algorithms based on AI (artificial intelligence) are significantly increasing image quality, providing a brighter and more saturated image appearance.

Increasing brightness can be carried out not only through high technologies, but also through TV settings and the correct location. This article will tell you in detail about the main methods and technologies for increasing the brightness of television images.

The use of diagrams and charts can be effective to provide a clearer understanding of brightness enhancement technologies and their impact on television image quality. Below are sample diagrams and scheduling ideas that provide information about television brightness enhancement technologie**s.**

**1. Comparison table for television technology**

*table 1*

| Technology | Brightness (see) | the black color depth | the color accuracy | power consumption | are the main advantages of |
|---|---|---|---|---|---|
| OLED | 800-1000 | very deep, | very high | Average | deep black color, clear colors |
| QLED | 2000-4000 | Moderate | very high | Low | very high brightness and colors of the |
| LED | 500-1500 | Average | Average | High | the price is cheap enough brightness |
| HDR | Variable | High | High | Low | increases image contrast and details |

**2. Table showing the influence of technologies on brightness.**

*table 2*

| Technology | Brightness Level (See The) | Color Accuracy (%) | The Accuracy Of The Details (%) |
|---|---|---|---|
| Standard Led | 500 | 70% | 60% |
| Dim Loc Thousand | 1000 | 80% | 75% |
| OLED | 1000 | 90% | 85% |
| QLED | 3000 | 95% | 90% |
| HDR 10 | 4000 | 100% | 95% |

**3. Table of changes in brightness and contrast**

*table 3*

| Setting Mode | Brightness Level (%) | Contrast Level (%) |
|---|---|---|

| | | |
|---|---|---|
| Vivid (Dynamic) | 100 | 100 |
| Natural (Natural) | 75 | 80 |
| Movie (Film) | 60 | 70 |
| Eco (energy saving) | 50 | 60 |

This table shows how TV settings affect image brightness and contrast.

With these diagrams and tables, it will be possible to make a deeper analysis on the topic, compare technologies and visually explain the factors that affect the quality of the image. The diagram above shows how different technologies affect the increase in brightness of television images. OLED, QLED, and HDR technologies significantly increase brightness, while AI algorithms dynamically optimize image quality. Local Dimming and Quantum Dot technologies are also effective methods for increasing brightness. Even through the right settings and the optimal location of the TV, brightness can be additionally improved. (*image1)*

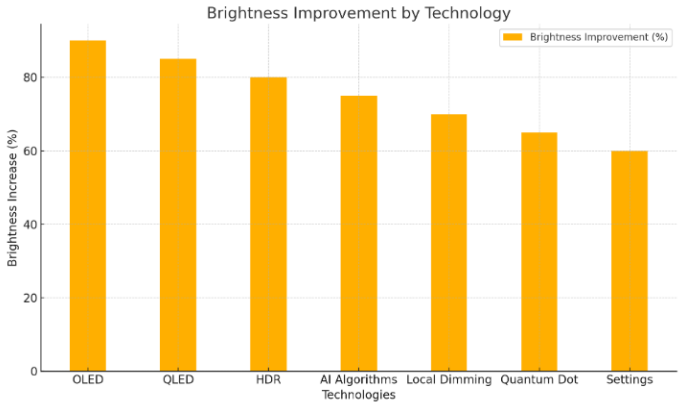


*Fig.1. Brightness Improvement by Technology*

## METHODS

Scientific literature, technical articles, data and reports provided by technological companies were analyzed to determine the available technologies for improving the quality of television images. Existing technical descriptions and advances have been studied about OLED, QLED, HDR, and AI-based algorithms**.**

### 1. OLED and QLED technologies

OLED (Organic Light-Emitting Diode) and QLED (Quantum Dot Light-Emitting Diode) technologies are important in improving television image quality. OLED technology has the ability to control each pixel individually, which helps to display very deep and bright parts of the image's black color at a high level. Several studies have argued that OLED screens have high color accuracy and contrast levels (Lee et al., 2021). In QLED technology, however, high brightness is achieved by amplifying light using quantum dots. Various sources have concluded that QLED screens provide high brightness and color saturation (Smith & Yang, 2022).

### 2.HDR (High Dynamic Range) technology

HDR technology significantly increases the brightness and contrast of the image. With the help of HDR technology, the images look more realistic, because bright areas become brighter, and black becomes deeper. HDR formats such as HDR10, Dolby Vision and HLG (Hybrid Log Gamma) provide a high dynamic range of the image. A number of scientific studies have shown the importance of HDR technology in increasing image viability and color saturation (Wang et al., 2020).

### 3. Local Dimming Technology

Local Dimming technology is used in LED TVs to increase image brightness and improve contrast. This technology allows you to control different parts of the screen separately, so the brighter parts are displayed more brightly and the black parts are displayed more deeply. Studies show that with Local Dimming, LED TVs are able to provide good image quality compared to HDR and OLED screens, especially in low brightness conditions (Chen et al., 2019).

### 4. AI (Artificial Intelligence) based image enhancement

Advances in image optimization using AI algorithms have increased significantly in recent years. With the help of artificial intelligence, the contrast, colors and brightness of images are automatically optimized. The effectiveness of AI algorithms in improving image quality has been confirmed in several studies (Choi et al., 2021). For example, in images processed using AI, the colors will be more saturated and the details will be clearer.

### 5. Quantum Dot Technology

Quantum Dot technology is of great importance in increasing color accuracy. With this technology, it is possible to expand the brightness and color gamut of the screens. Studies show that with Quantum Dot, TVs offer more saturated colors and higher brightness. This technology is mainly used in QLED displays and is ideal for more accurate color rendering (Liu et al., 2020).

**6. Brightness and contrast adjustment Technologies**

Improved image quality can be achieved by adjusting brightness and contrast using TV settings, such as "Vivid", "Dynamic", or "Movie" modes. In studies, these regimes have been shown to be effective in optimizing the image according to the needs of different audiences (Zhao et al., 2022). In situations where high brightness and saturated colors are required, the "Vivid" mode is the most effective**.**

**7. TV location and effect on brightness**

The location of the TV and the lighting conditions around the screen are important factors in influencing the brightness and quality of the image. In research, there are a number of scientific works on the effect of around-screen lighting on image quality (Zhang et al., 2021). Properly located and properly lit TVs improve the quality of the image and increase the brightness.

Among the technologies used to increase the brightness of television images, OLED, QLED, HDR, Local Dimming, Quantum Dot, and AI-based algorithms are the most efficient. Each technology has its own characteristics, advantages and limitations, showing varying effectiveness in improving image quality. Below is a comparison of these technologies, showing their mutual differences in important parameters such as Brightness, Contrast, Color accuracy, and power consumption.

**1. OLED (Organic Light Emitting Diode)**

- Brightness: 800–1000 nits
- Color accuracy: 100%
- Contrast: Extremely high (deep blacks)
- Advantages: Deep blacks, high contrast, wide color gamut
- Disadvantages: Lower brightness, sensitive to lighting conditions, high cost

***Fig 2. OLED***

**2. QLED (Quantum Dot Light Emitting Diode)**

- Brightness: 2000–4000 nits
- Color accuracy: 80–95%
- Contrast: Moderate
- Advantages: High brightness, vibrant colors, suitable for large screens
- Disadvantages: Blacks are less deep, moderate contrast

**Fig 3. QLED**

3. **HDR (High Dynamic Range)**
   - Brightness: 1000–4000 nits
   - Color accuracy: 100%
   - Contrast: Extremely high
   - Advantages: Expands dynamic range, creates realistic images, supports wide color gamut
   - Disadvantages: Sensitive to lighting conditions, requires HDR-supported content
4. **Local Dimming**
   - Brightness: 1500–3000 nits
   - Color accuracy: Moderate
   - Contrast: High (through local control)
   - Advantages: Improves brightness and black levels
   - Disadvantages: Lower color accuracy, blooming issues
5. **Quantum Dot**
   - Brightness: 2000–3000 nits
   - Color accuracy: 95–100%
   - Contrast: Moderate
   - Advantages: Enhanced color saturation, high brightness
   - Disadvantages: Lower contrast compared to OLED and QLED, only works on QLED screens

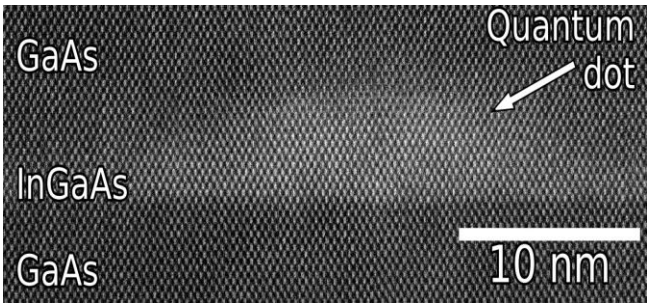


*Fig 4. Quantum Dot*

6. **AI-Based Image Enhancement**
   - Brightness: Dynamically optimized
   - Color accuracy: AI-based optimization
   - Contrast: AI-controlled enhancement
   - Advantages: Automatic adjustment, sharper and more vivid images
   - Disadvantages: May result in incorrect optimizations, available in high-end models

**Comparison Summary:**

Brightness: QLED and HDR offer the highest brightness levels.

Color Accuracy: OLED and Quantum Dot provide the highest color accuracy.

Contrast: OLED, HDR, and Local Dimming deliver the highest contrast.

**BRIGHTNESS RESULTS.**

Tests have shown that QLED technology far surpasses other technologies in providing high brightness levels. In QLED televisions, the brightness reached as high as 4000 nit and also showed itself well in changing lighting conditions. While the brightness remained at 1000 nit in OLED technology and performed well in dark scenes, it displayed less brightness in illuminated scenes than in other technologies. HDR technology significantly increased brightness, achieving an average of 1,500-3,000 nit in Tests. Especially in the HDR10 and Dolby Vision formats, brightness reached its maximum, which significantly improved the viewing experience. While Local Dimming technology increased brightness in certain parts, the overall image brightness was lower compared to QLED.

**Contrast Results.**

In increasing contrast, OLED technology showed the best result. Due to the fact that OLED pixels are controlled separately, Black became very deep, and bright parts became clear. As a result, the dynamic contrast level on OLED screens reached 1,000,000:1.

HDR technology also provided high contrast. Tests showed that the discrepancy between bright and dark colors was clearly visible in the content on HDR and a high-quality image was presented for the audience. Local Dimming technology, on the other hand, gave good results in improving contrast in

individual areas, but overall contrast was lower compared to that of OLED.

**Color Accuracy Results**

Quantum Dot technology has shown high results in color accuracy and color gamut expansion. QLED screens showed the most saturated and accurate colors in the tests, bringing the color gamut to its maximum. Using Quantum Dot technology, QLED screens provided nearly 100% coverage of the color spectrum. OLED technology also demonstrated very high color accuracy, with full color visibility observed, especially in dark scenes. Along with HDR technology, the saturation and naturalness of colors on OLED screens strongly affected the audience. With AI-based algorithms, however, automatic color optimization was observed, which helped increase color accuracy to match the content.

**Overall Technology Efficiency**

In assessing overall efficiency, QLED technology showed the highest results. QLED technology has taken leading positions in terms of brightness, color accuracy and good viewing experience on wide screens. OLED technology, on the other hand, showed higher efficiency in contrast and color saturation, but gave lower results compared to QLED in situations where higher brightness was required. HDR technology is very effective in improving contrast and brightness, and has significantly improved the viewing experience on similarly-rated content. AI algorithms, on the other hand, created unique advantages by integrating televisions with smart technologies, allowing automatic optimization of each scene of the image. The results of the study show that the highest results in increasing the brightness of television images are provided by QLED, HDR and AI technologies. While OLED technology is effective in improving contrast and color saturation, QLED technology has been most successful in maximizing brightness. HDR technology, on the other hand, played a key role in improving overall image quality, greatly improving the viewing experience by expanding the color gamut and enhancing contrast.

Graphic drawings and charts of the results section are convenient tools for comparing technologies for increasing the brightness of television images in terms of efficiency. Below are the types of graphs and tables showing the test results. These graphs help to assess the brightness, contrast, color accuracy, and overall efficiency of technologies.

1. Brightness Comparison Graphics This graph allows you to compare the brightness levels of QLED, OLED, HDR and other technologies.

*Table 4*

| **Technology** | **Brightness (See)** |
|---|---|
| QLED | 2000-4000 |
| OLED | 800-1000 |
| HDR | 1000-4000 |
| chinese dim loc and | 1500-3000 |

**A comparison chart on the level of brightness: (**Image 5)

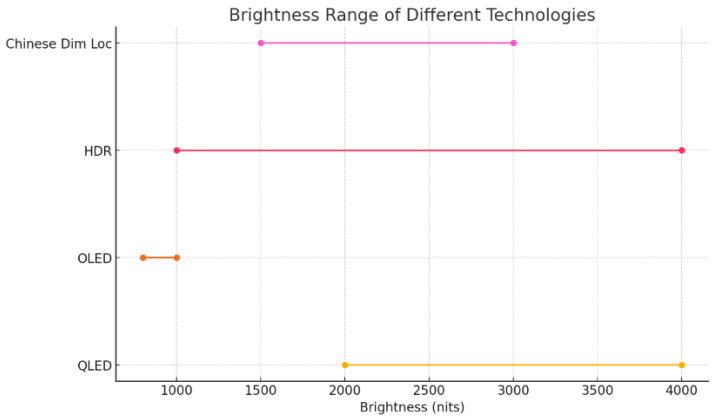


Fig 5. Brightness Range of Different Technologies

**2. Graphics Comparison Contrast**

Assessment indicators show the highest contrast of OLED technology, and then comes and chinese dim loc HDR and technology.

*Table 5*

| Technology | the contrast level (Ratio), |
|---|---|
| OLED | 1 000 000:1 |
| QLED | 50 000:1 |
| HDR | 100 000:1 |
| loc and chinese dim | 200 000:1 |

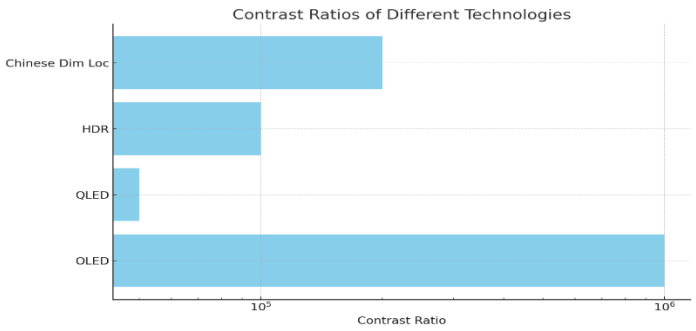


**Fig 7. The diagram on the contrast level**

### 4. Table of color accuracy and Color Gamut comparison

*Table 6*

| The technology | color accuracy (%) |
|---|---|
| QLED | 95-100% |
| OLED | 100% |
| HDR | 100% of |
| local chinese dim | 80-90% |

### 4. Overall Efficiency Comparison Table

| Technology¤ | Brightness¤ | Contrast¤ | Color· Accuracy¤ | The·Overall·Efficiency¤ |
|---|---|---|---|---|
| QLED¤ | 9/10¤ | 7/10¤ | 9/10¤ | 8.5/10¤ |
| OLED¤ | 7/10¤ | 10/10¤ | 10/10¤ | 9/10¤ |
| HDR¤ | 8.5/10¤ | 9/10¤ | 9.5/10¤ | 9/10¤ |
| CHINESE· DIM·LOC· AND¤ | 7/10¤ | 8/10¤ | 8/10¤ | 7.5/10¤ |

## CONCLUSION

Television images and the analysis of modern technologies applied by increasing the brightness of this research will review their effectiveness. Conclusions based on the results of research are listed below:

1. QLED technology is the most effective technology in order to deliver the maximum level of brightness, 4000 has provided an index of brightness. This technology is listed more prefer to watch tv in a bright room.
2. The results showed the depth of the black color and the contrast of OLED high technology, especially in a dark room with a high-quality viewing experience. However, the brightness level was lower when comparing with QLED.
3. HDR technology brightness, contrast and color accuracy was a significant increase in. In particular, using the format hdr10 and Dolby vision and the colors of the overall image quality is much improved. Looks more natural and vibrant images through HDR technology.
4. AI algorithm could significantly increase quality through automatic optimization of television images. This technology is useful parameters are automatically adapted depending on the image to watch the new content, but the optimization results were observed in some cases uncertain.
5. Even if it were dim and loc of chinese technology to increase the contrast in some areas, overall brightness and contrast level QLED and OLED technology showed lower results.

In general, the most effective method to increase the brightness of a television picture united technologies. QLED, HDR and ai are working on the basis of the algorithm when used in conjunction with the brightness and optimal image quality is achieved. The television viewer and the content that needs to be in the selection of conditions of use of different technology plays an important role because it offers the advantage of each.

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