
R&D - Research and Development in STRL/ Japan

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NHK Science & Technical research
Laboratories (STRL)

CONTENT

○TERRESTRIAL DIGITAL BROADCASTING

○Video on mobile reception (3 minute)

○DIGITAL EQUIPMENTS

○NEW DEVICES FOR BROADCASTING

○Video on STRL open house (26 minute)

Digital Broadcasting for Anyone, Anytime, Anywhere

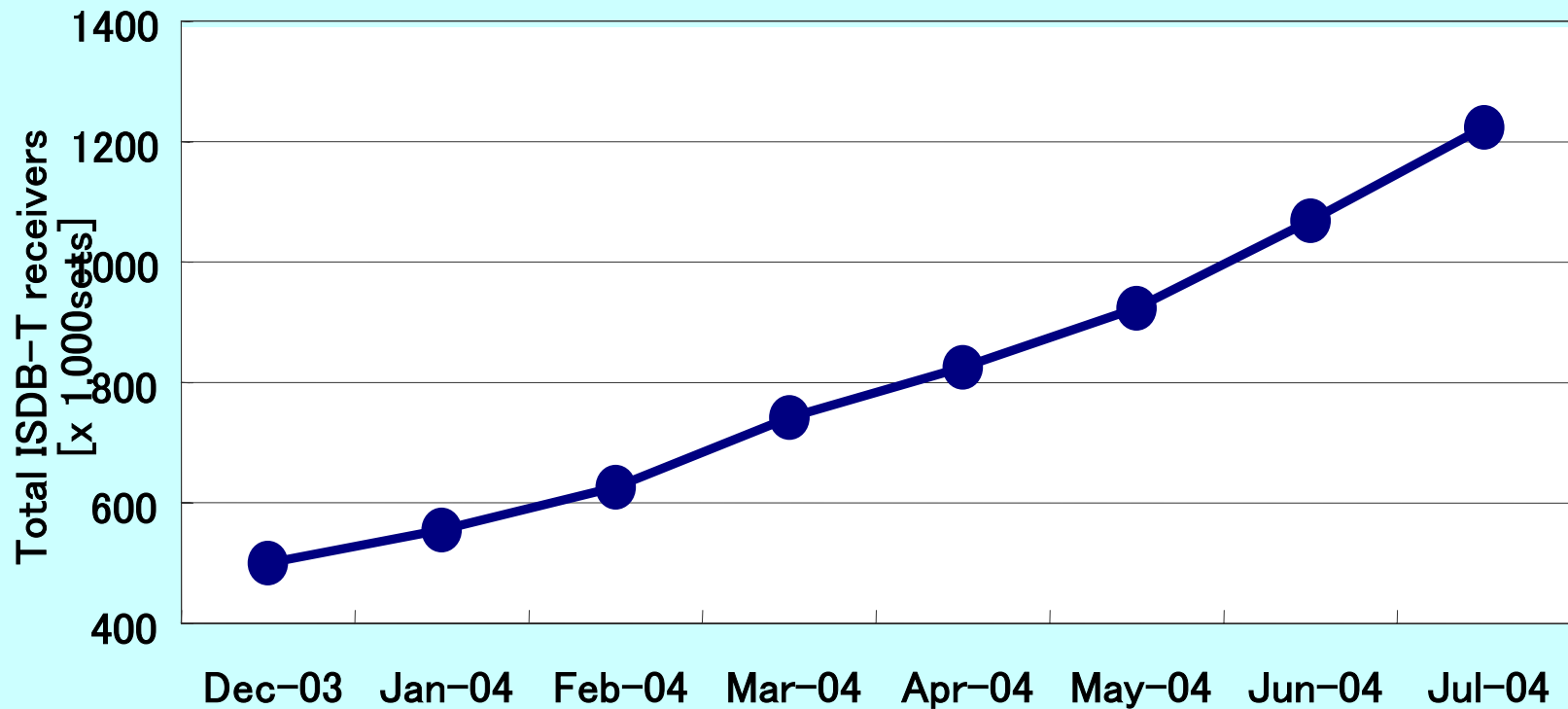
- Integrated services television
provided anytime the viewer wishes
- Mobile reception "anywhere"
- Broadcasting services for "anyone"

Digital Broadcasting

for Anyone, Anytime, Anywhere

- **Digital terrestrial television broadcasting was launched in the three major metropolitan areas of Tokyo/Osaka/Nagoya on December 1 2003.**
- **Along with digital satellite broadcasting, which started in 2000, this new form of broadcasting makes a transformation in Japanese Broadcasting: digital technology will lead to new functions and interactivity for television.**
- **Digital terrestrial radio broadcasting also began experimental broadcasts in Tokyo and Osaka in October 2003, and the next few years will surely see new radio services as well as TV services.**

2004 Domestic Shipments of ISDB-T Receivers



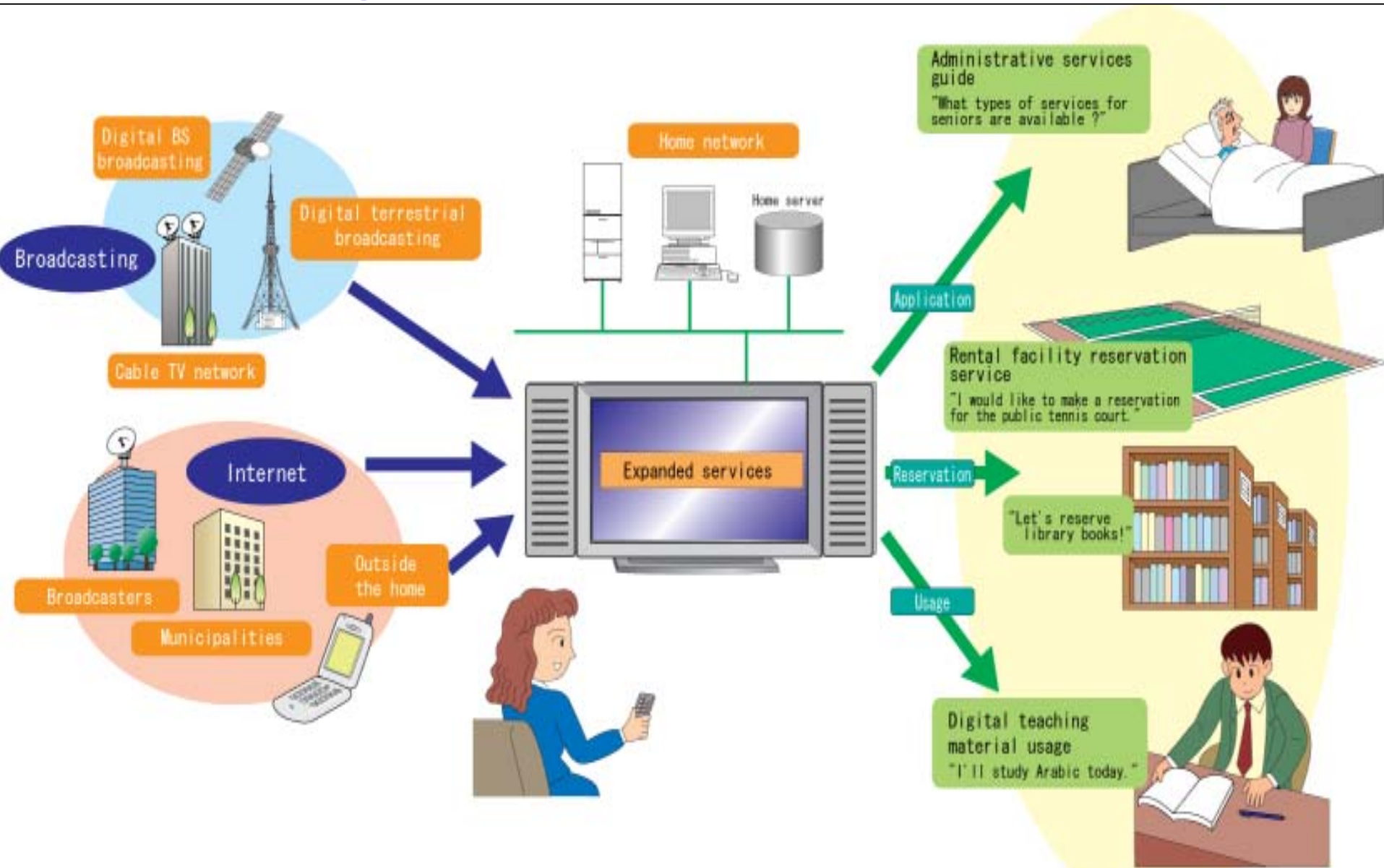
Digital Broadcasting for Anyone, Anytime, Anywhere

- **The digitalization of broadcasting has become a global trend because more information can be provided at a lower cost compared with analog; this is obviously a significant advantage for both viewers and broadcasters.**
- **In fact, digital broadcasting via satellite is already in over 60 countries, and digital terrestrial television broadcasting services have started in 14 countries, including the United Kingdom, the United States, Germany, South Korea, and Japan. The pace at which digital radio broadcasting is spreading is also increasing in many parts of the world.**

Network-linked Broadcasting Services

- Digital TV becomes
“Integrated services television”
- Nearly all digital broadcasting receivers are equipped with a standard connection for viewing information from the Internet in combination with regular broadcasting in Japan.
- In the near future, the TV, the most familiar medium, will likely develop into a gateway to the information society.
- Digital television could become indispensable as a medium offering new services that cross the traditional borders of broadcasting and communications.

Integrated Services Television



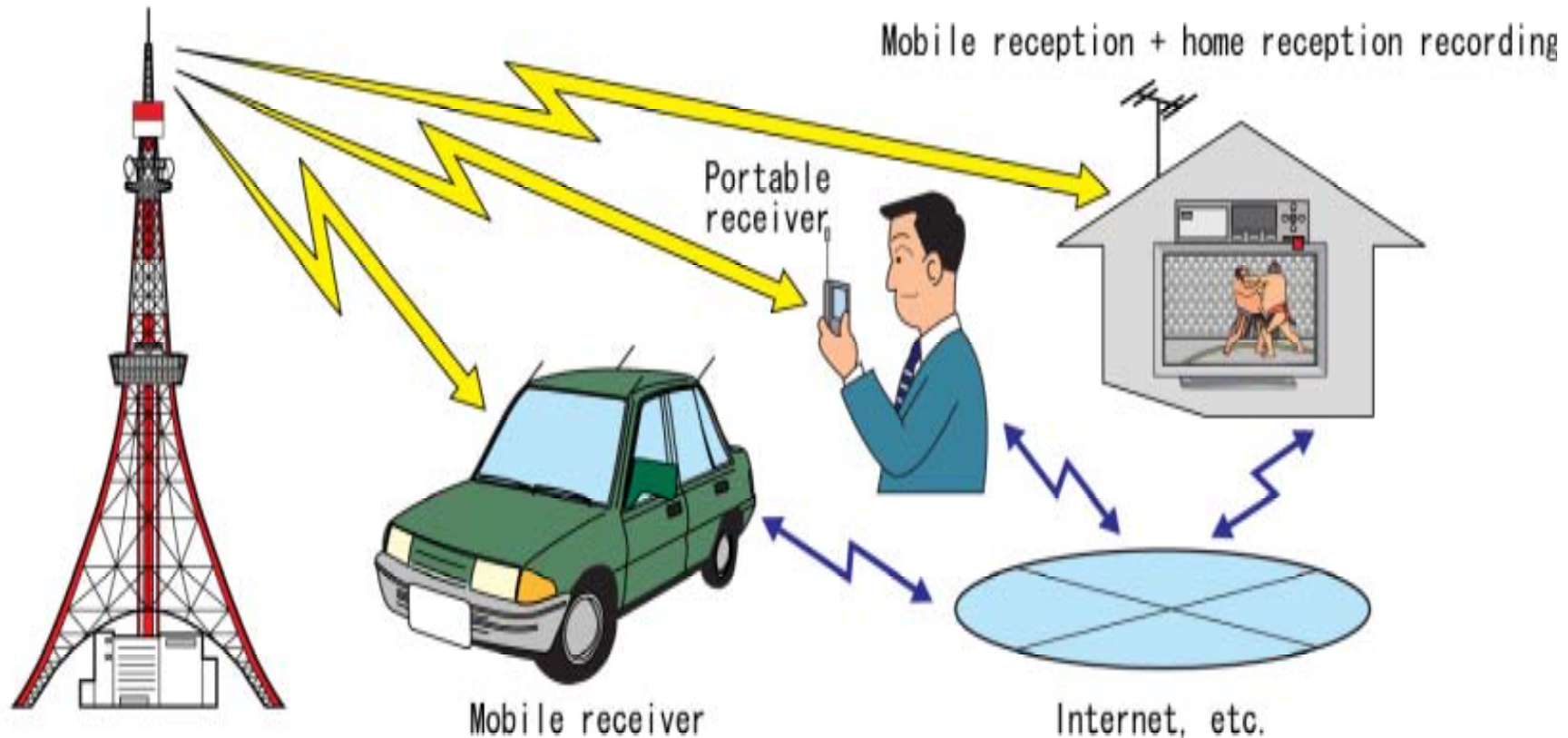
"Integrated services television" system image

Digital Terrestrial Broadcasting for Mobile phone & Portable Receivers

- **Mobile phone and portable TV receiver prototypes were constructed for our studies of data broadcasting linked with the internet. Reception experiments are being carried out with them, using actual broadcasting and communication signals.**

Digital Terrestrial Broadcasting for Mobile & Portable Receivers

Digital terrestrial broadcasting



Network-linked data broadcast services for mobile reception

Portable Reception on Handy Phone (NTT docomo)



Portable Reception on Handy Phone (KDDI)



Portable Reception on Small TV



Portable Reception on PDA



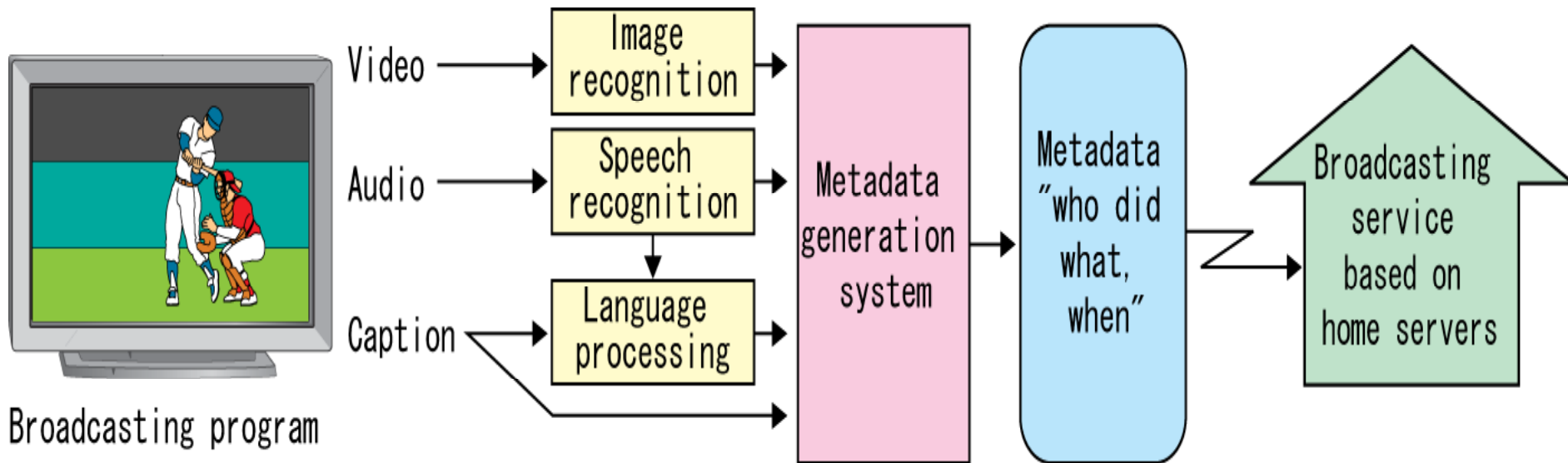
Services Image of Mobile Reception



Services Image of Mobile Reception



Metadata Production & Applications



Metadata generation flow

Metadata Production & Applications

- The system can identify individuals on screen by using face recognition technology, and can categorize scenes based on their pattern and composition.
- Speech recognition and language processing technologies are applied to analyze the speech data, to extract information that corresponds to scene content, including keywords to describe speech content, and data related to who, when, and what action was taken.
- Closed captions can be used to generate useful metadata for digest viewing and scene retrieval at the receiver side.

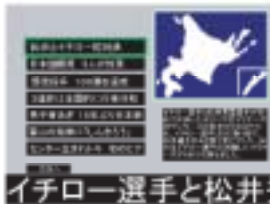
Human-friendly Digital TV

○ Combines a simple-operation remote control and a menu display.

Broadcasting services for people with visual or hearing impairments



Closed-captions with speech recognition



Enlarged display/tactile presentation

Broadcasting services for elderly people

Audio service especially adjusted for elderly viewers

Easy-to-use digital receiver



Slower speech

I can easily understand the program at this slower pace.



Human-friendly digital broadcasting

CONTENT

- **TERRESTRIAL DIGITAL BROADCASTING**
- **Mobile reception Video(2 minute 30 sec)**
- **DIGITAL EQUIPMENTS**
- **NEW DEVICES FOR BROADCASTING**
- **STRL open house Video(26 minute)**

Latest HDTV Broadcasting Equipment



Latest HDTV Broadcasting Equipment

○ Highly mobile wireless HDTV camera.

This unit has a built-in compact, energy-saving codec/transmission system and enhanced mobility. The use of the orthogonal frequency division multiplexing scheme (OFDM) scheme improves mobility by allowing transmission beyond the line-of-sight.

○ Postcard-size HDTV codec

The LSI circuit reduces the size of the codec to 1/200th of the previous model and saves energy. It will be incorporated in various HDTV transmission devices.

Latest HDTV Broadcasting Equipment

○ Multi-format converter for any standard TV format

A clever arrangement of the functional elements and the use of integrated circuits (ICs) contribute to making this a compact, lightweight, energy-saving device. High-quality picture TV signal format conversion was realized through the motion compensation function.

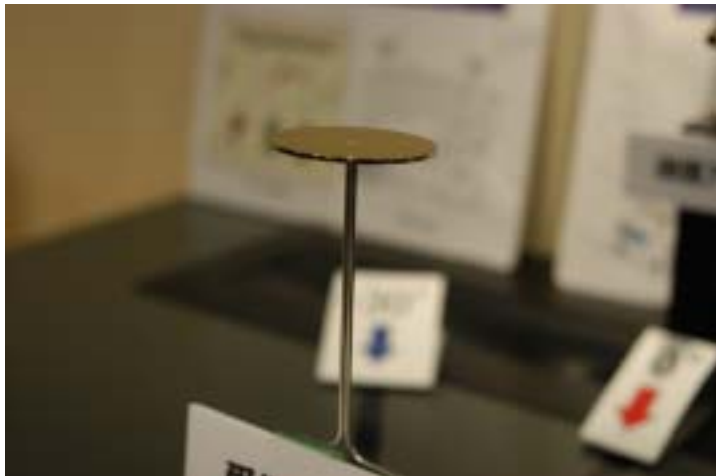
○ Compact HDTV down-converter

This compact down-converter only uses one IC that can perform all of its essential functions. Consequently, we get higher quality as well as low power consumption and a low price.

Latest HDTV Broadcasting Equipment



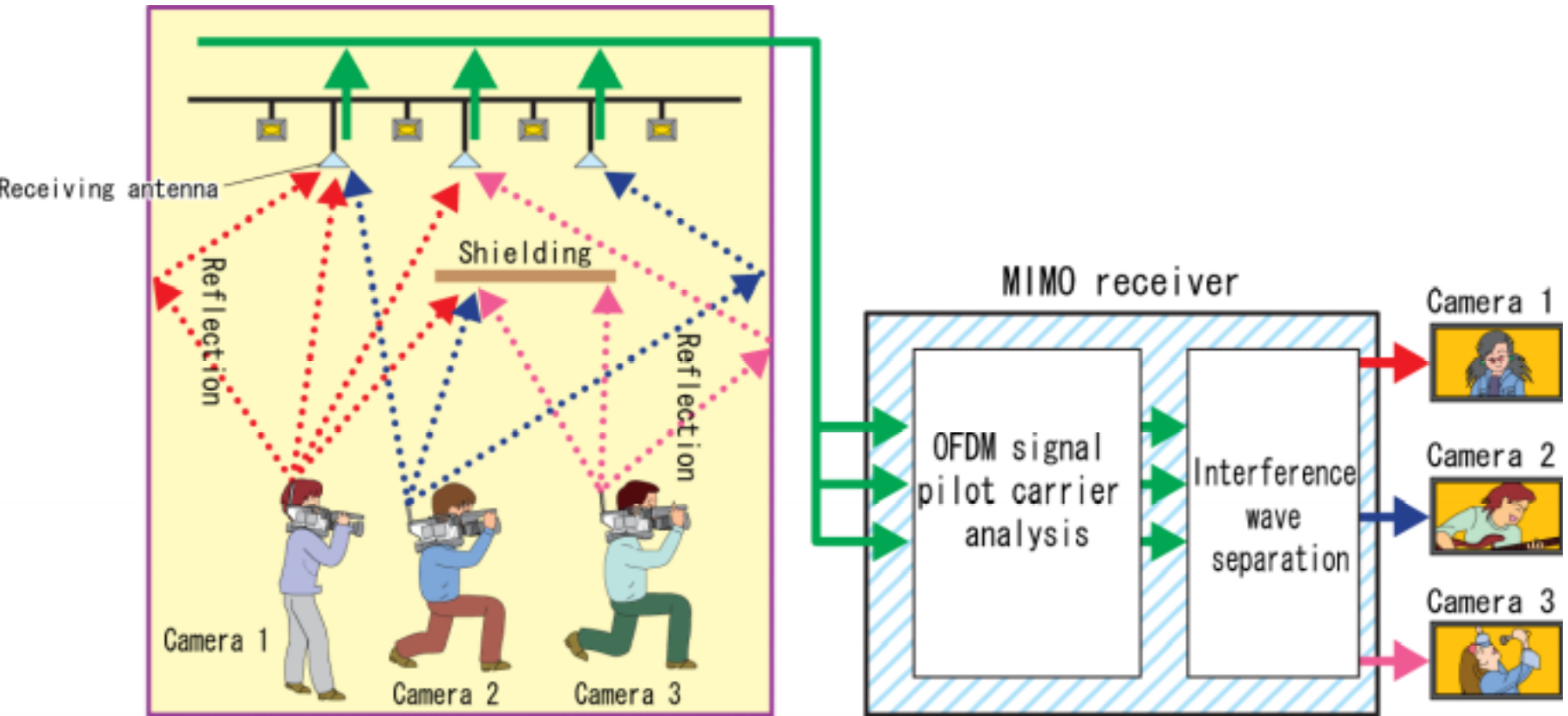
Millimeter-Wave Mobile Camera



Millimeter-Wave Mobile Camera

- The use of the broadband millimeter-wave bands enables high-quality picture HDTV video transmission.
- The orthogonal frequency division multiplexing (OFDM) scheme is robust against multipath interference in a studio where radio signals reflect off walls, ceiling, and floor

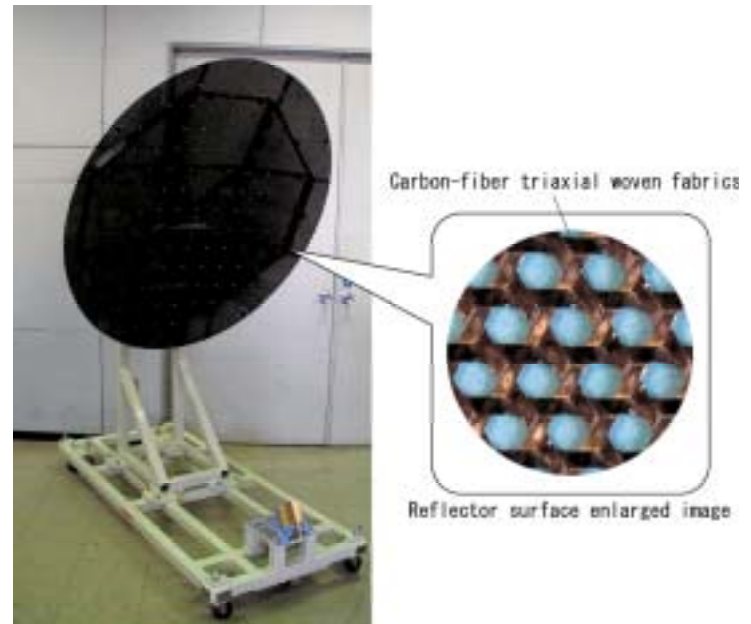
Millimeter-Wave Mobile Camera



Millimeter-wave mobile camera using MIMO transmission scheme

Advanced Satellite Broadcasting Technology

- Mesh reflector antenna
- Basic model for rain attenuation compensation
- Long-block-length interleave transmission system



Mesh-reflector antenna

Image Compositing System Using Omni-directional illumination



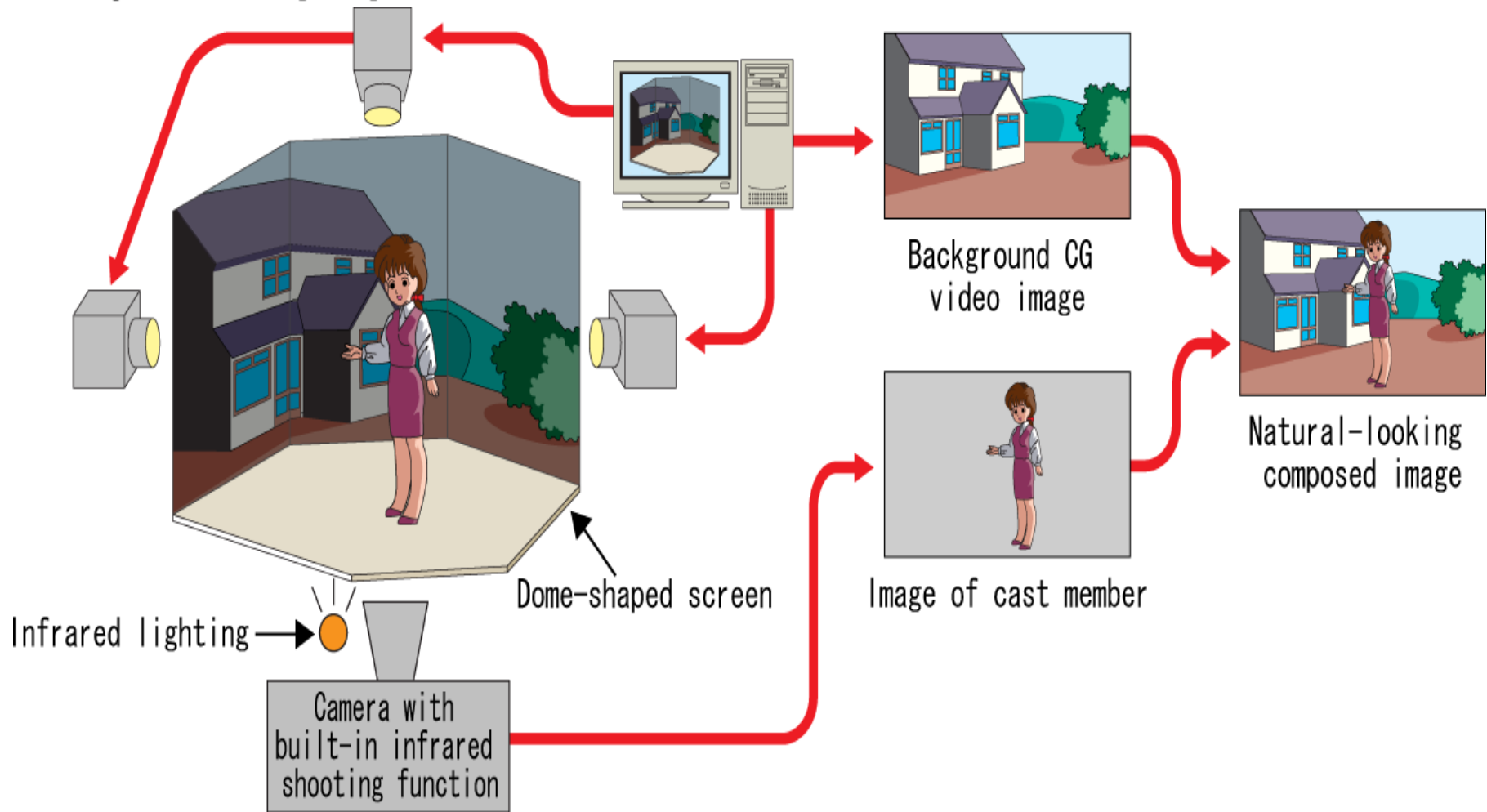
Image Compositing System Using Omni-directional illumination

This system extracts area information from the image to be combined with the CG image. It does so by using infrared rays, which impose no restriction on the visible lighting conditions or the color of the clothes worn by the cast members, unlike the chroma-keying method.

The brightness of the CG video projected around a dome-shaped screen is used as omni directional lighting for the cast. This enables the use of light appropriate to the CG video scene.

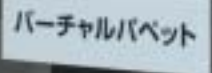
Image Composting System Using Omni-directional illumination

- Projector for lighting



Lighting stage for virtual studio system

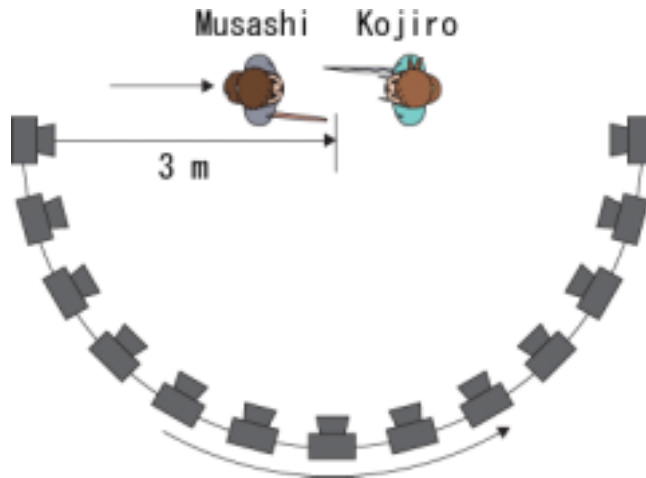
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Multi Viewpoint Camera System

- **30 digital cameras arranged in a line vertically (or horizontally) on an arc-shaped steel pipe base take sequential shutter images, with the capability of covering 180 degrees in a second.**
- **The next stage is computer video processing to generate composite still pictures, with 30 pictures used to create one-second of motion picture.**

Multi Viewpoint Camera System



Multi-view shooting system



Actual performance shoot

Free Viewpoint Video Representation Technology



Free Viewpoint Video Representation Technology

- The system generates a 3D shape model based on images from 19 cameras surrounding the subject.
- It uses the model to generate arbitrary view images as would be seen from any position or angle.

Integral 3-D Television

- **Integral 3-D television can acquire three-dimensional information about a subject all at once.**
- **3-D image: 3-D display system that allows a user to experience a stereoscopic effect**

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○ **Mobile reception Video(3 minute)**

○ **DIGITAL EQUIPMENTS**

○ **NEW DEVICES FOR BROADCASTING**

○ **STRL open house Video(26 minute)**

DISPLAYS

○Flexible Ultra-thin Displays

○Field Emission Display for Future Ultrahigh-definition TV

○PDP Discharge Simulation Technology

Flexible Ultra-thin Displays



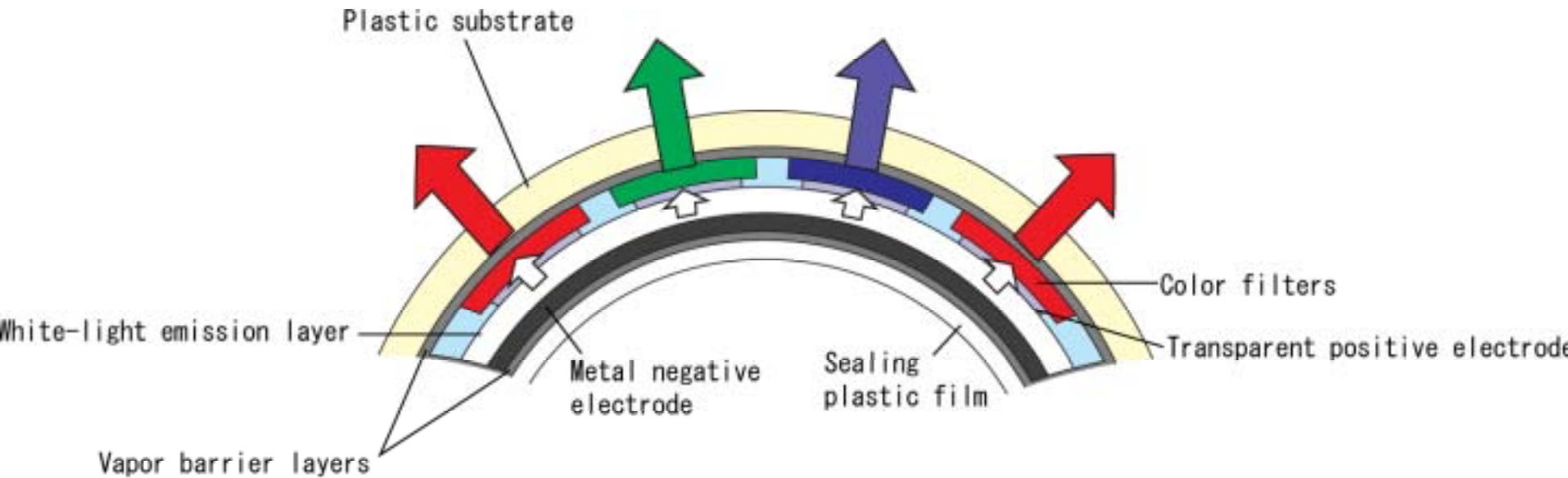
Flexible Ultra-thin Displays



Flexible Ultra-thin Displays

- A lightweight, ultra-thin display that can be rolled up.
- We have fabricated a flexible organic electro luminescent display and a flexible liquid crystal display, and we are studying driving technologies using organic thin-film transistors (TFTs) for both displays.

Flexible Ultra-thin Displays

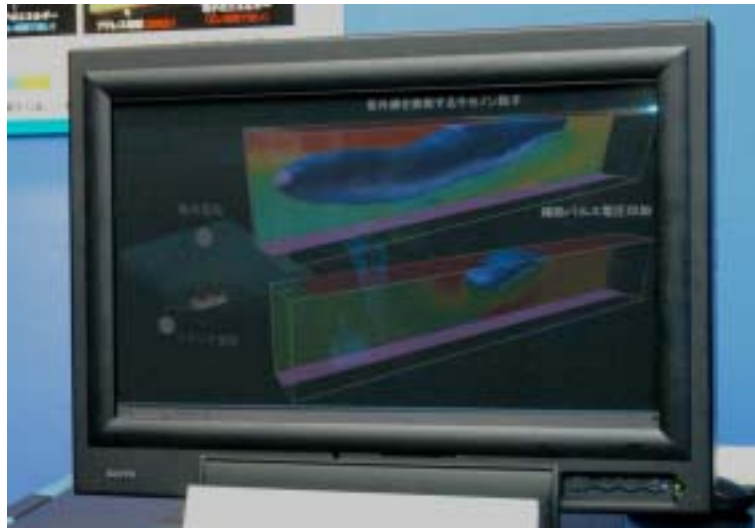


Flexible organic EL display cross-sectional structure

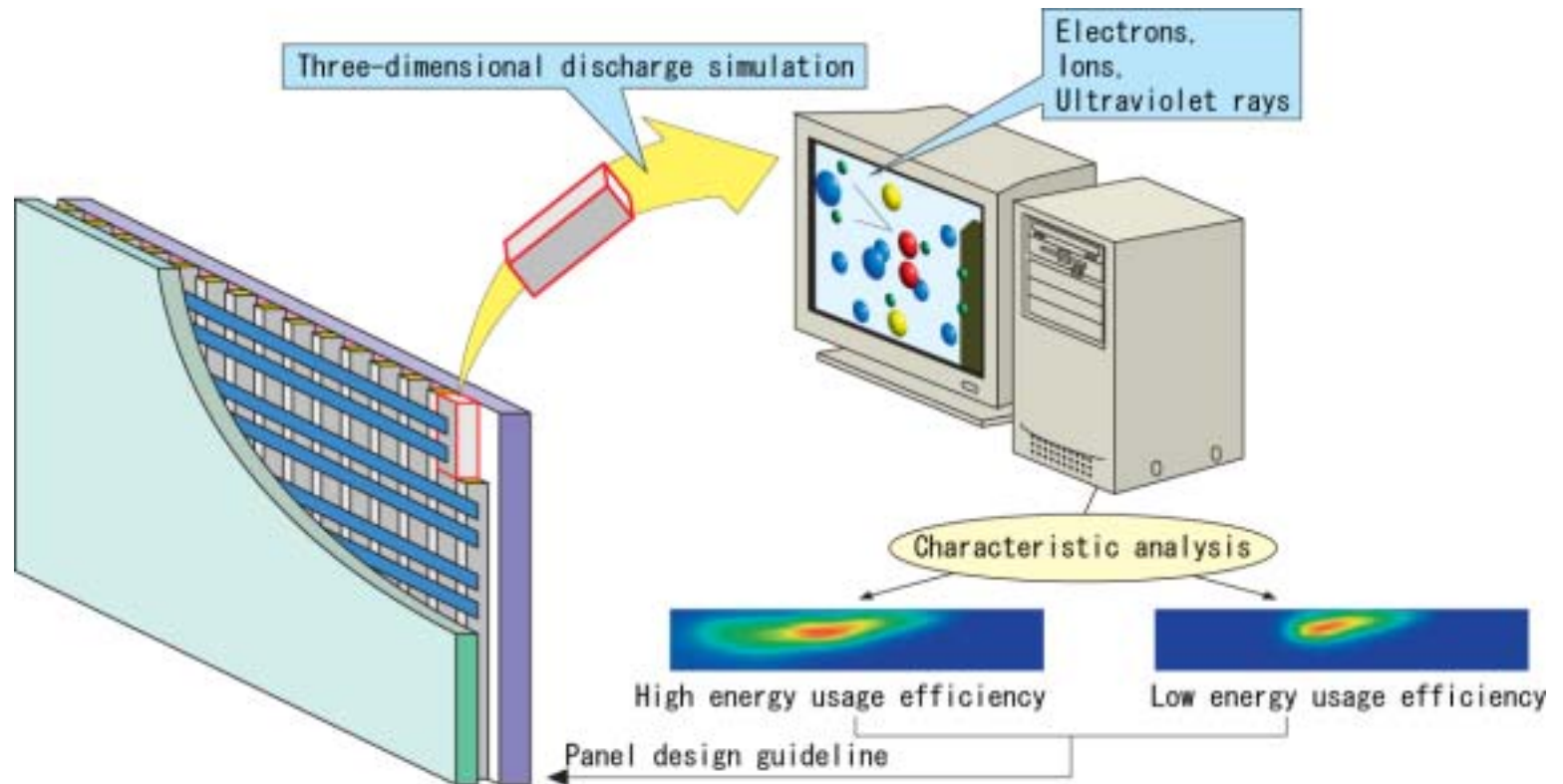
Field Emission Display for Future Ultrahigh-definition TV



PDP Discharge Simulation Technology



PDP Discharge Simulation Technology



PDP discharge simulation configuration

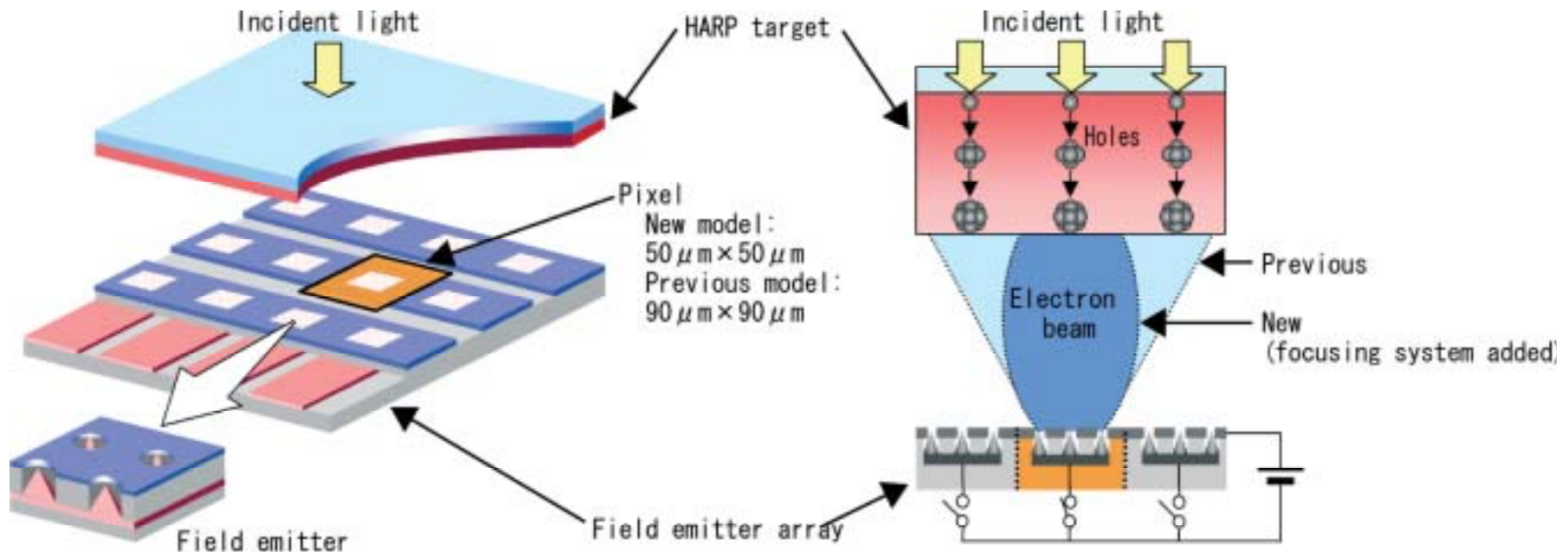
PDP Discharge Simulation Technology

- This is a highly accurate three-dimensional simulation that produces models of electron movement and the emission process of ultraviolet rays that excite phosphors in a discharge cell.
- The simulation lets us analyze the energy efficiency of the discharge, which is a guideline to improve luminous efficiency. In particular, this simulation can be used to optimize the discharge cell structure and driving waveform.
- The simulated discharge phenomena can be visualized in an easy-to-understand manner.

Field Emitter Array Image Sensor with HARP Target

- **Ultrahigh sensitivity:** the HARP target that was previously developed for an image pickup tube can be applied to this system.
- **Ultrahigh definition:** the field emitter array is manufactured using integrated circuit fabrication technologies.
- **Low power consumption:** the electrons are emitted from field emitter array at a low voltage without heating.

Field Emitter Array Image Sensor with HARP Target



Structural and operational comparison of new and previous field emitter array image sensors

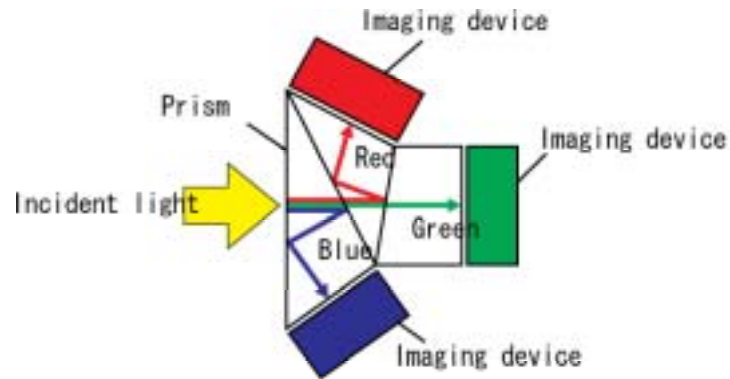
Image Pickup Device Using Organic Films



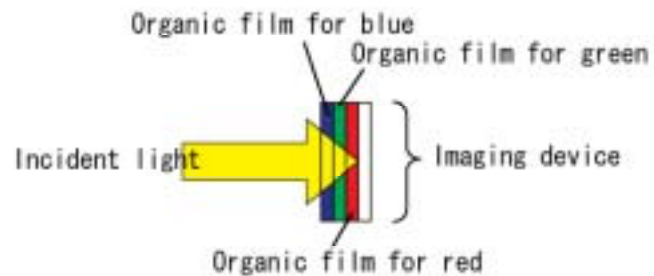
Image Pickup Device Using Organic Films

- Organic photoconductive film on which the following characteristics were confirmed.
- Organic material has the property of absorbing only a specific color of light, the appropriate use of organic material should lead to the fabrication of individual photoconductive films that can select one color of light (blue, green, or red). By layering these photoconductive films, a color imaging device can be constructed that is capable of separating incident light into the three primary colors in the depth dimension of the films and outputting electrical signals for each color.
- Organic film has the high resolution required for HDTV.

Image Pickup Device Using Organic Films

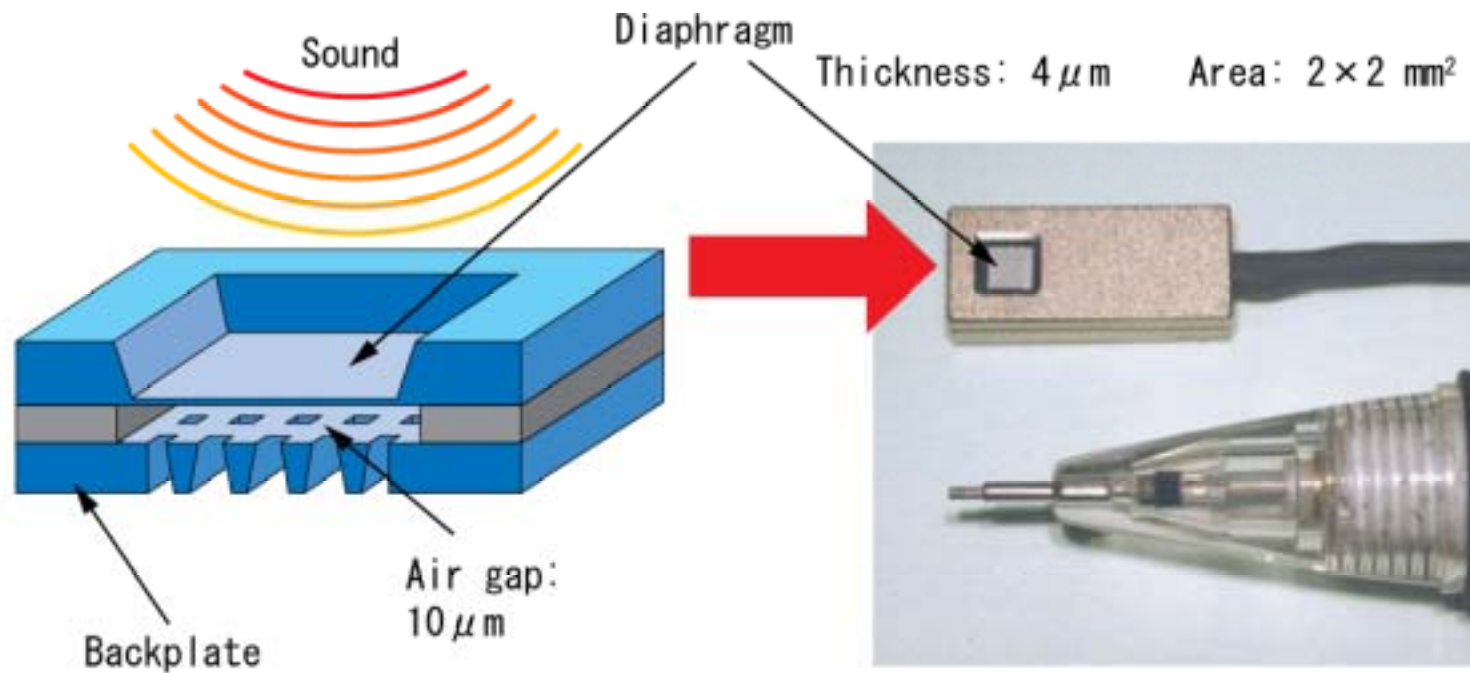


Present HDTV camera for broadcasting



Future HDTV camera with organic films imaging device

Ultra-small Silicon Microphone



Microphone element cross-sectional view

Silicon microphone



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