HIGH DEFINITON TECHNOLOGY:A REVIEW

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ABSTRACT

This is a review paper describing the characteristics and benefits of high definition (HD) technology. Digital techniques offer greater accuracy and stability, with better signal to noise ratios than analogue method. Here the overview of High Definition is presented; basic terminology, working, fundamentals, applications and future of this technology are listed. The scanning methods have been explained also software and hardware architecture is mentioned. The analysis of the current HD market and a commercial survey of the HD services and its providers have been carried out. Then the future of High Definition is considered with new research directions. If we narrow down the issue to a single parameter, that of resolution, aside from possible future displays that are integer multiples of 1920 x 1080 serving to diminish pixel structure then, claims of "live-the-picture" and "feel-the-picture" would become a reality.

Keywords:

HD; Pixels; Interlaced scan; Progressive scan; Blu-ray; HDMI; Ready 3D; Real HD; Aspect Ratio; Retina display.

1. Introduction

On 2nd November 1936, BBC began transmitting the world's first high definition service from the Victorian Alexandra Palace in north London; this is the birthplace of HD television broadcasting [1]. For several years standard definition has been the reference compression system for broadcast applications in general. HD is the latest development in the world of home entertainment. The market of home entertainment is advancing at a rapid rate. Many new designs and interfaces are developed and introduced in the market but only a few designs make a mark.The most recent and influential technology is HD technology. HD video has a higher resolution

than SD video; it has one or two million pixels per frame, which is five times that of SD. It has 16:9 aspect ratios. Most HD formats are either 720 or 1080 line resolution. 1080p has a larger frame size (1920 x 1080) than 720p (1280 x 720). Approximately 2.25 times more pixels are used in 1080p.With time, not only the transmission quality has improved but also there are better receivers on TV sets are better. There are 1080 lines on older screens hence the pixels, are much smaller and closer together. Digital signals are sent as zero ones and ones and can travel longer distances without degrading. Most HDTV sets support high definition 5.1 Dolby surround audio, comparable to the sound of the type you would expect from a good stereo system.

2.Working

In Standard TVs charged electrons are shot from a 'gun' at the back of a picture tube to illuminate pixels. While in HD TV's digital signals are used that is a changing pattern of 1's and 0's.The Fig1 below shows the working of the Over the Air Transmission (OTA) using satellites and Set-Top boxes. Orbiting satellite receives information from the service provider then transmits that information. The customer dish acts as an antenna. The dish picks up the signals and sends them to a receiver set-top box (STB).

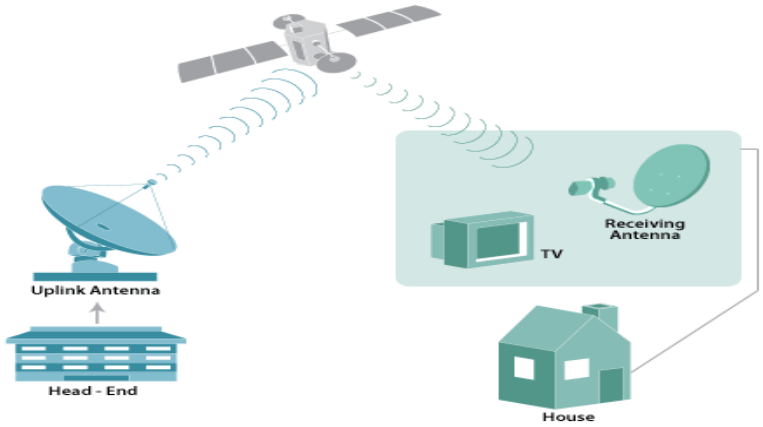

Fig1: Over the air transmission [4]

The Fig2 below shows how in interlaced scanning the lines on the screen are divided into odd and even lines which are then alternately refreshed at 30 frames per second. The delay between odd and even line refreshes creates some distortion or 'jaggedness'.

Odd lines Even lines Complete Image

Display Rate: 30 frames per second
Fig2:Interlaced Scanning [2]

Frame1: All lines Frame2: All lines

Display Rate: 60 frames per second

Fig3: Progressive Scanning [2]

In progressive scan as shown in Fig3 above, each line is scanned in a sequential numerical order unlike odd and even lines alternately in case of interlaced scanning. It scans the image onto the screen every 60th of a second. Progressive scanning is considered superior as there is less jitter.

3.Fundamentals of High Definition

3.1 Hardware (Set-top-box)

A STB is composed of a number of small functional blocks or modules, with each module performing a well-defined function. The STB tunes to one of many input channels in order to select the appropriate broadcasting TV information [3]. The STB contains some form of modem to allow it to send and receive interactive data. The signal is digitally modulated using modulators like QPSK, QAM, and OFDM. The information is then processed by the demodulator and passed to MPEG-TS decoder giving output of audio, video, and other information that relates to the selected TV program. The central processing unit (CPU) monitors the whole operation and carries out specific data function. It uses a Real Time Operating System (RTOS) on top of a hardware abstraction layer for the management of the resources and processes of the STB. The conditional access (CA) module is the most important component of the set-top box. Thisperipheral is placed before the demultiplexer for descrambling the encrypted signal. When a viewer wishes to watch any TV channel, it gives the input in form of remote command and gets the output as interactive data like audio and video with the help ofinteraction with CPU.

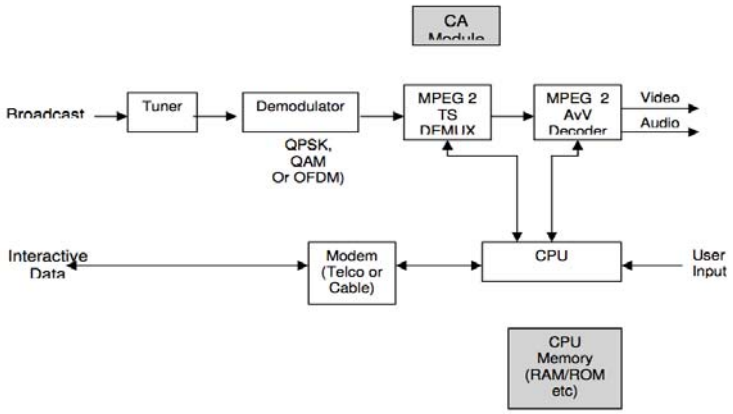

Fig4: Hardware of Set-Top box [3]

3.2 Software (Set-top-box): An operating system is the most important piece of software in a STB. An OS is a sort of programs used to manage the resources in STB.It is the OS, which communicates to the STB hardware and manage their functions such as scheduling real time tasks, memory management, and process scheduling, etc. The architecture of STB OS is designed in layer with others layers adding new functionalities and capabilities to carry out tasks. The heart of any STB OS is the “Kernel” layer, which is stored in ROM. Generally the kernel is responsible for managing memory resources, real time applications and high-speed data transmission. The kernel supports multithreading and multitasking which allows a STB to execute different

sections of a program and different programmes simultaneously. Every hardware component of STB has a driver. A driver is collection of codes that decodes the commands from the TV viewer to a format that is recognizable by the hardware device.

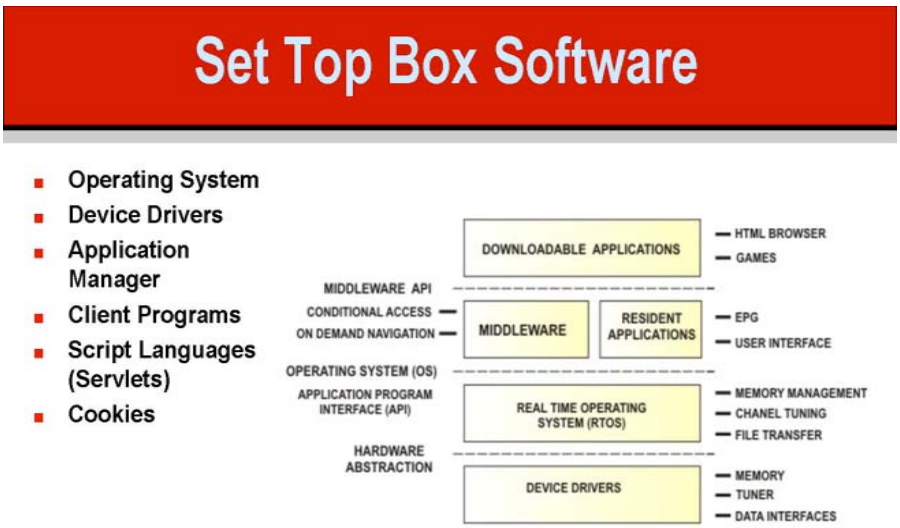

Fig5: Set-Top box software [5]

The center of software architecture comprises of connection layer called as Middleware. Middleware represents the logical abstraction of the middle and upper layers of the communication software stack used in set top software and communication system. The processes in software component communicate with each other by Application Programming Interface (API). An API is basically a set of building blocks used by software developers to write programs that are suitable for STB OS environment. Next to Middleware layer is Real time Operating System (RTOS). The key function of RTOS is to serve real time application. It performs the main role in giving process priorities and provides scheduling flexibility. Leading companies providing their software for set-top box areCelstream, Promwad**,** Sigma designs**,** Celrun**,** Amino**,** Microware**,** Microsoft windows CE.

A. Hardware (HD TV): The standard circuit of a HD TV as shown in Fig6 below consists of two areas where video processing occurs. In the case of SD signals there is a block called the video digitizer.

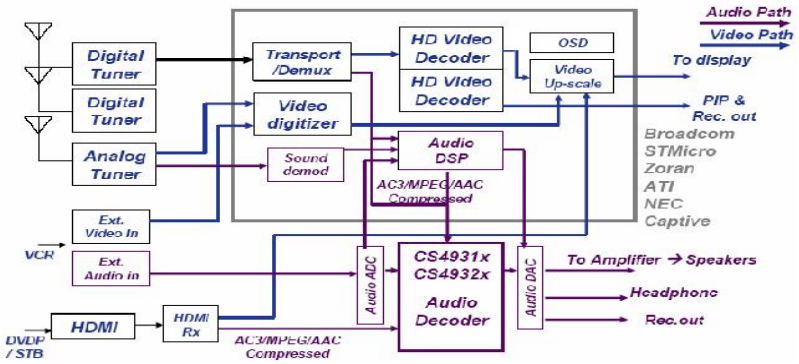

Fig6: Circuit diagram of a HD TV [10]

It is here that the signals from the analog tuner and the analog inputs are fed. The signal is digitized and then converted to a memory bit array and then processed. The output of this video digitizer is then sent to the Video Up scaler, where the output is built for the resolution of the display available. HDTV-ready TVs are capable of rendering high definition video from DVD, satellite or cable receiver, but it cannot be used for watching HDTV over-the-air (OTA) broadcasts as it lacks a tuner .One can purchase an external HDTV tuner.

B. Applications and Future Perspective

High Definition has its application in fields like Film Making since recording the films in HD video cameras gives more image details than HD video formats, HD has changed the face of video conferencing [12] as it is one of the main components of high end tele-presence, Video gaming consoles [8] comes with the high definition technology, since then consoles have proved themselves to be the best in digital entertainment and Surveillance [9] has become important for reasons of security. HD video cameras provide better picture detail and the recorded high definition video allows better tilt and zoom. The future of HD is Ultra High Definition (U-HD). U-HD has 16 times the resolution (7680 x 4320) of current HDTV, and it will be unavailable to the people for at least 25 years. There is no LCD or plasma screen in the world with a high enough resolution to display its pictures. TV broadcast system cannot cope with the massive amount of data which needs to be sent to create an Ultra HD [13] picture. JAPAN's NHK [6] has successfully sent video using its own high bandwidth optical link and by using a state of the art projector.

4. Analysis

In this section the main parameters in High Definition technology are compared for SD, Ready HD and Full HD. Majorly six parameters that are useful in distinguishing the three are discussed.

Table1: Comparison between SD, Ready HD and Full HD [7]

Parameters	SD	Ready HD	Full HD
Pixels	480	720	1080
Resolution	720x420	1280x720	1920x1080
Aspect Ratio	4:3	16:9	16:9
HD playback	No	Via DVDs & components	DVDs, components &OTA
HD tuner	No	No	Yes
HD	No	Yes	Yes

Pixelswhich arethe smallest unit of picture that can be represented or controlled in a raster image, or the smallest addressable screen element in a display device. Resolution of a digital television or display device is the number of distinct pixels in each dimension that can be displayed. The next parameter is aspect ratio which is the ratio of the longer dimension to its shorter dimensionHD playback is the supports of HD content via DVD components.HD television tuner allows reception of digital television (DTV) television channels transmitted by television stations. Whereas the HD converter converts the SD resolution to HD resolution. Though Full HD requires a HD tuner from the observations in the table1 above we can make out that, it is the best to get a live picture quality experience with maximum number of pixels, highest resolution, a wide aspect ratio and portability.

5. Conclusion

High definition has caught attention in recent times since when people have started paying more attention towards quality**.** Today, watching TV is simply staring at a box, but in the future, watching TV at home will be an even more interactive experience with additional sensory stimulations. More and more people are experiencing high-definition movies and television in breathtaking color and detail. Considerable achievements have been obtained in recent years like compact hardware structures in turn making the TV slimmer and better and we can finally say that High Definition (HD) is here, and here it shall evolve. More and more research in this field has demonstrated its usefulness due to which the software has become more advanced. Applications in the field of HD filming, HD Video conferencing, HD in video gaming, Spy Pens, HD Video Surveillance depict how HD is gaining popularity. If we narrow down the issue to a single parameter, that of resolution, aside from possible future displays that are integer multiples of 1920 x 1080 serving to diminish pixel structure and improve the performance of scaled image output from lower resolution formats, 1080p i.e. Full HD, is king.

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