DIGITAL CINEMA

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Abstract –Digital cinema encompasses every aspect of the movie making process, from production and post-production to distribution and projection. A digitally produced or digitally converted movie can be distributed to theaters via satellite, physical media, or fiber optic networks. The digitized movie is stored by a computer/server which "serves" it to a digital projector for each screening of the movie.

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1. INTRODUCTION (Digital Cinema)

What is a Digital Cinema?

- Digital Cinema means the transmission and delivery of films to theatres electronically where the image is stored in a computer server and beamed onto the theatre screens.

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- It uses Digital Media instead of analogue media (Prints).

- Digital Cinema uses digital projectors instead of analogue projectors.

- Digital Cinemas use digital processes end to end – right from the capture (digital movies are shot using digital CCD based cameras with high resolution).

- It Storage (they are stored in digital tapes, hard disks or flash drives).

- Processing (editing, mixing, re-recording, sound, special effects etc are handled in the digital format), display .

- Distribution (digital cinema copies are mostly transmitted electronically over the Internet or satellites or even hard disks).

I.   History :-

- June 18, 1999 DLP cinema projection in North America

- By December 2000, there were 15 digital cinema screens in North America, 11 in Western Europe, 4 in Asia, and 1 in South America.

- February 2, 2000 Digital cinema projection in Europe

- March 2002, Digital cinema initiatives was formed a joint project of many motion picture studios(Disney, Fox, MGM, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. Studios).

- April 2004, testing of 2K and 4K playback and compression technologies.

- August 2006, first Indian digital cinema was released.

- January, 2007 "Guru" became the first Indian movie in Jpeg format.

- March, 2009 4K projector start.

- June, 2010 there are 16000 digital screen.

- And of 2012 80% of word wide cinema screen would be converted to digital.

- As of 31 March 2015, 38,719 screens (out of a total of 39,789 screens) in the United States have been converted to digital (15,643 of which are 3D capable).

II. WHY GO DIGITAL

- Vision can now actually be seen by audiences.
- Duplication costs removed.
- Larger numbers of theatres can now view simultaneously.
- Transportation costs can be replaced by much lower transmission costs .
- More flexible scheduling .
- New entertainment ideas .
- Higher quality entertainment (better picture and sound).
- Easier access to screenings .

III. COMPONENTS OF DIGITAL CINEMA

A. Digital Cameras

- Digital cameras can shoot with a resolution of 2k, 3k, 4k and some even higher!

- The higher the resolution, lower the possible frame rates. The depth of field is usually equivalent to 35 mm cine lenses.

- These cameras generally contain more than 10 Mega Pixels and 4k resolution means 4520 x 2540 pixels.

- Digital media connectivity for direct recording is provided with the cameras via USB, HDD, Compact Flash Module, Solid State RAM etc.

B. Digital Cinema Projectors

These projectors directly accept and play digital format images in high quality.

DLP – Digital Light Processing technology to project images while some of them might use LCD or some kind of modified LCD crystals for projection.

Common projectors support 2k, 4k resolutions and have a brightness level in excess of 15,000 Lumens.

The digital cinema projectors support input/output formats according to the DCI standards .

There are optional lenses to change the throw distances to adjust according to the theatre conditions.

- **DLP cinema projectors**

Three manufacturers have licensed the DLP cinema technology developed by Texas Instruments (TI).Christie Digital Systems, Barco, and NEC.
 Early DLP Cinema projectors,used limited 1280×1024 resolution or the equivalent of 1.3 MP (megapixels).

- **Sony SXRD projectors**

SXRD projectors have only ever been manufactured in 4K form and, until the launch of the 4K DLP chip by TI,

the SXRD projector functions as a sub 2K projector, the same for HFR 3D Content.

C. Satellite transmission

The cinema is ready to be distributed to the various movie halls.
The digital data is sent electronically over the Internet, leased lines, and satellites.

D. Theater management system

Digital cinema is displayed using digital projectors which are controlled by industry standard servers with management software in the theatres.

There is an optional Theatre management software to enable easy set-up, scheduling and management of multi-screen shows (usually in a multiplex with multiple screens) over the central network so that subsequent manual intervention may not be required.

- **Digital Cinema Servers:**

The encrypted data is received and decrypted by the digital cinema servers which are located at the individual cinema halls.

It then re-encrypts it and outputs the image data to the digital cinema projector and audio data to the sound processor.

The theatre projectors of today support 128 bit AES encryption/decryption for media.

The digital cinema servers generally support the most common JPEG 2000 media playback format.
provide a sort of an external remote to control basic functions like Play, Pause, Stop etc.

E. Fiber optics

Some of them have a direct fiber termination option for connecting to the network.

F. Speaker

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IV.   TYPES OF DIGITAL CINEMA

1. 2D Digital Cinema
2. 3D Digital Cinema
3. 4D Digital Cinema
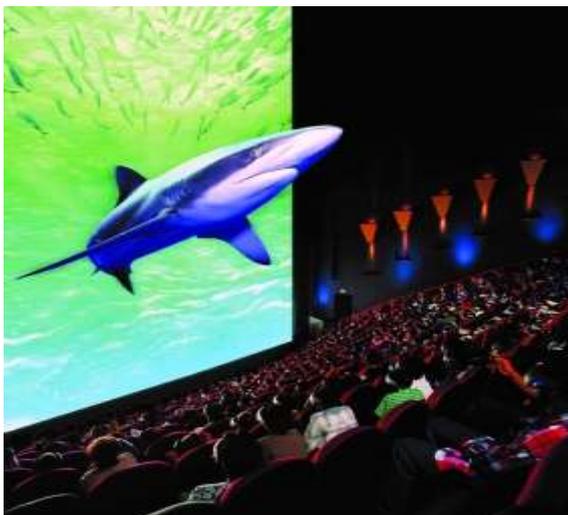4. 5D Digital Cinema

2D DIGITAL CINEMA

- Pictures can not jump off the screen.
- Feel is behind on the scene.
- Low switching speed of images.

➢ *3D DIGITAL CINEMA*

- Provide the perception of depth of image.
- Images are jump off of the screen.
- High switching speed.

➢ *4D DIGITAL CINEMA*

- 3D View
- 4D Effects
- Some seat movements
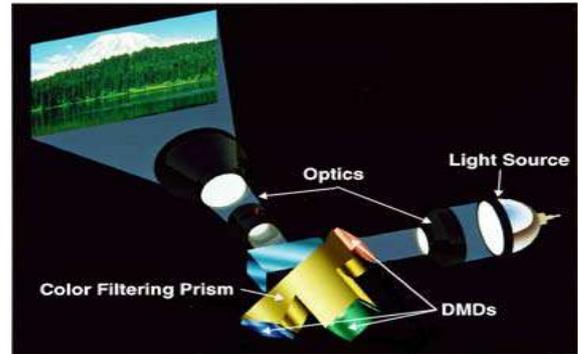

➢ *5D CINEMA*

- Seats move in synchronization with motion in movie.
- At least six directional seat movement is required.
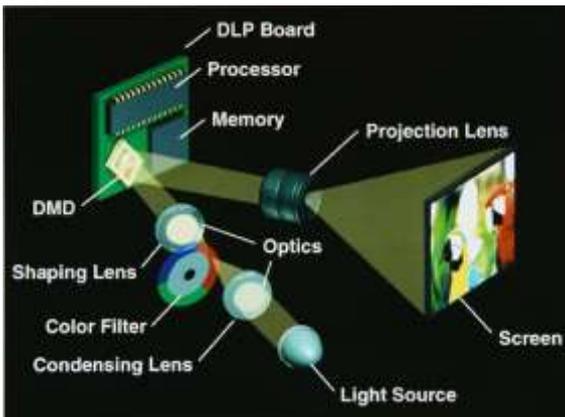- Short duration movies.

V.   DIGITAL CINEMA OVERVIEW

VI.   IMAGE CAPTURE

- Professional Digital Camcorder.
- Standard Film Camera.

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VII.   SINGLE DMD SYSTEM

- Color images can be made by shining colored light onto DMD grayscale image.
- Light from source bulb is filtered using spinning color wheel.
- Combination of red, green or blue light is then reflected to optics from DMD.

VIII.   3 DMD SYSTEM

- Light from source bulb is diffracted using filtering prism.
- Each color component (red, green and blue) is reflected from its own dedicated DMD.
- Reflected R,G and B light combined and passed through optics to display.
- Reduced mechanics (no spinning wheel) means the system is more reliable.
- Dedicated mirrors also mean higher quality pictures.

IX.   AN EARLY HISTORY OF DIGITAL CINEMA
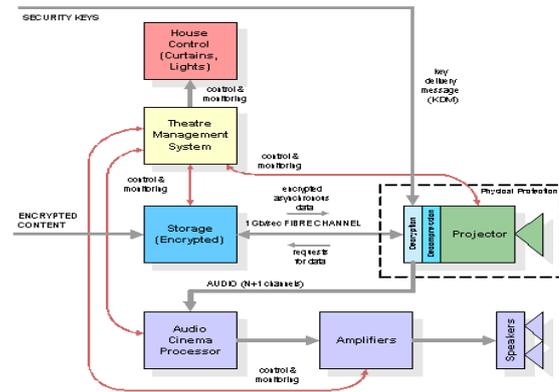
X.   DIGITAL CINEMA AFFECTS THREE MAJOR AREAS OF MOVIE-MAKING

- ➢ *Production*

- ➢ *Distribution*

- ➢ *Projection*

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XI. How Digital Cinema Works

- In addition to the equipment already found in a film-based movie theatre a DCI-compliant digital cinema screen requires a digital projector and a computer known as a "server".

- Movies are supplied to the theatre as a digital file called a Digital Cinema Package (DCP). For a typical feature film this file will be anywhere between 90 and 300GB of data (roughly two to six times the information of a Blu-ray disc) and may arrive as a physical delivery on a conventional computer hard-drive or via satellite or fibre-optic broadband.

- Currently (Dec 2013) physical deliveries are most common and have become the industry standard. Trailers arrive on a separate hard-drive and range between 200 and 400MB in size.

- The necessary decryption keys are supplied separately, usually as email attachments and then "ingested" via USB.

- The playback of the content is controlled by the server using a "playlist".

- The playlist can be started manually, by clicking the "play" button on the server's monitor screen, or automatically at pre-set times.

XII. Advantages and disadvantages of Digital Cinema

- *Advantages*

  - Colour of image is not corrupted.
  - Broadcasting of live conferences.
  - Low budget cinema.
  - Limited man power.
  - Automatic schedule.
  - Introduce special effect.
  - Occupy less space.
  - Addition/ deletion of scene easier.
  - Simple to handle.
  - Fast.

- *Disadvantages*

  - Projection quality.
  - Film based projector.
  - Higher risk of piracy.
  - The quality of digital projection is comparable with analog film based projection.

XIII. Applications

- IN THEATRE
- LIVE BRODCASTING OF MOVIES
- IN TELECOMMUNICATION

XIV. FUTURE SCOPE

- 6 D Digital cinema
- 7 D Digital cinema

XVII. Acknowledgement

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