

Digitizing Traditional Filmmaking Process for Education and Industry

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ABSTRACT

For many years Cinema is entertaining its audience around the world, this is the source of entertainment that had evolved immensely and had produced fascinating movies. Besides being the most glamorous money making industry, it is also the most expensive industry. It is very costly to use traditional equipment and traditional methods; it is the process that takes some years to get completed. Many talented individuals want to join this industry, but because of its high cost and overflowing budget, they hesitate to step forward. Therefore in this research, digitizing them at competitive cost has focused innovative ways of filmmaking. Efforts have been made by the authors to make filmmaking affordable by the learners at reduced cost. The potential and interest in filmmaking in the Middle East have been highlighted in the paper. The paper also explains why students are unable to learn filmmaking on traditional equipment, which is due to slow growing technology in this region regardless their potential and interest. To overcome this issue, the authors discuss different methods of digital film production that help not only Middle Eastern students but also students around the world. In the end, advantages, and challenges of the digital film the authors describe production and related work in this field. Integration of digitizing film industry and Artificial Intelligence can also yield an exponential growth in film industry not only in middle east but also worldwide.

Keywords

Digital filmmaking, Digital cinema, Digital era of filmmaking, Filmmaking in middle east, Migrating traditional cinema to digital cinema, New age of independent filmmaking, Teaching digital filmmaking.

1. INTRODUCTION

Cinema has a long history of entertaining the general public, and it is a source of entertainment that is continuously improving. Its evolution and rise in demand for new styles requires filmmakers to learn new cinematic techniques. However, filmmaking process is never been easy from the beginning, and also it is not an affordable process. Cinema had not only challenged film schools to train students to produce films, but also require them to adapt the techniques that can make the process faster and inexpensive.

In the recent years, computing technology has been improved/advanced in many areas, and one of the areas is the film production. Many traditional filmmaking methods have already digitized with the help of latest innovative computing technology. Organizations like Adobe, Black Magic Design, and Avid had contributed immensely to improve the digital filmmaking process.

Adaptation of digital method of producing films has already overcome the issues of complex process and the cost involved during the movie production. However, in terms of globalization, this method was not yet adapted in the Middle East region, until the author introduced it to some universities teaching filmmaking courses. The main reason of choosing the Middle East for the introduction of this platform was because of its market value and potential in students. Students found this method ingenious and straightforward, especially those who were working on the film for the first time.

Detailed comparison between traditional film production and digital film production has been described in section 2. Section 3 explains different stages of digital film production for teaching. Advantages of digital film production are presented in section 4. Section 5 narrates challenges of digital filmmaking. Related work is described in section 6. Section 7 concludes the paper and focuses future work.

The authors had as of now presented digital film production in Bahrain (Middle East) and led three noteworthy understudies venture from classroom to the silver screen. These three projects are discussed further in this segment:

1.1 Anthology Film (Paranorma: There is always a dark side 2011):

Anthology film is a feature film, which comprises several short movies. This practice is best to prepare understudies to deliver movies because students need to work in diverse groups, and working in distinctive gatherings helps understudies to complete tasks on time. With collaboration, students work together that results in best projects, and they get a good team working experience too.

The author first taught the technical part of the digital camera to the students, with the goal that they could get their hands on advanced camera workings. Because of the effortlessness, yet propelled components of the digital camera, they figured out how to utilize it in couple of weeks. In the wake of gathering thoughts and story line of the motion picture, students were separated into three gatherings for three unique stories, which they later arranged on screenwriting software "Adobe Story." When the students finished their footages, they were taught how to recover the digital footage and fare it into non-linear editing software, for example, Adobe Premier,

and after that in the second last stage, they were prepared to utilize the real procedure of non-linear editing. In the final phase, students learned the techniques of computer-based colour grading/correction, and compilation process for the screening (the post production process used in movie “Paranorma” can be seen in Figure. 1 and Figure. 2, and a movie still can be seen in Figure 3) In the end, the film was shown to the Bahrain's ministry of culture representative and was screened in the year 2011. The primary motivation for presenting this course was to comprehend the understudies' capability, and the business sector estimation of the local films, the best system to deliver the first understudy film and to screen it on the silver screen before the mass gathering of people was the digital film production process.

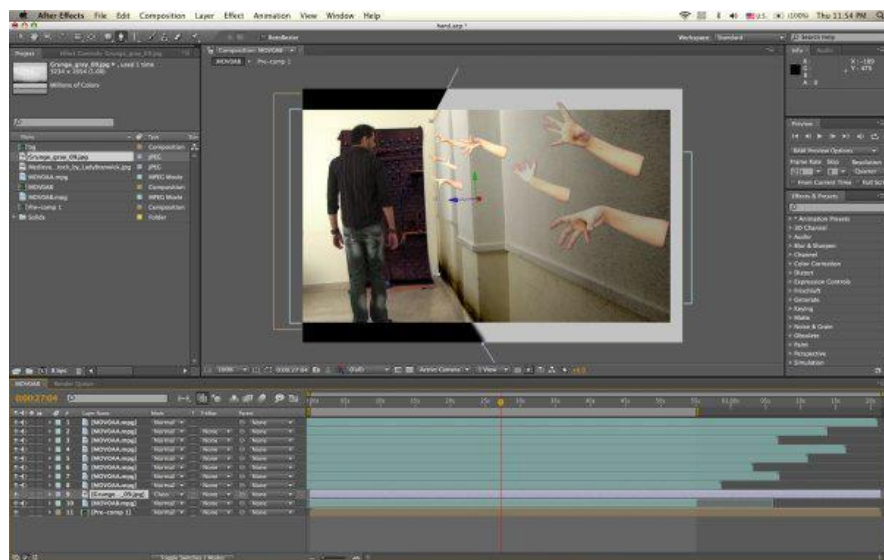


Figure 1. “Post Production” shot from the film “Paranorma.”



Figure 2. Student working on the movie project

Figure 3. A Scene from the movie

1.2 Visual Effects Based Film (Silveraven: 2012)

After the successful release of the first film in Bahrain, author pushed the students further. This time author planned a course that continues the previously taught digital film process and introduce them to the visual effects process. In the traditional world, visual effects techniques are achieved through arduous efforts. The process involves the huge amount of manpower and lengthy process, such as non-computer based matte paintings, keying and rotoscoping (these methods are used to import unreal objects in the movie and remove the unwanted objects from the film to give surreal effects, and to perform impossible tasks.) On the other hand, the digitization of visual effects made it easier to apply on any film and achieve realistic results in less amount of time. In this new project, students were taught the visual effects process in both traditional and digital ways, but most of the part covered gets related to a digital process. Students learned the digital matte painting, keying and roto-scoping by using Adobe After Effects; they also learned the particle effects to create fake rain, explosions, and dust blows. Students were working on visual effects for the first time, before this they had only seen it in the movies [39]. This movie also got screened at the Bahrain Cinema, the completion time of this film project was four months, and the duration of the film was 57 minutes (the movie stills of “Silveraven can be seen in Figure 4) .



Figure 4. Few scenes from the movie “Silveraven.”

2. TRADITIONAL FILM PRODUCTION VS DIGITAL FILM PRODUCTION

The traditional and digital film production is usually divided into five major stages: (i) Development (ii) Pre-Production (iii) Production (iv) Post-Production and (v) Distribution [1]. While working on the traditional production, these five stages are further divided into sub-stages that get completed at different locations and each sub stage requires different workspace. After finalizing the long process, these phases and sub-stages

are then centralized; this method requires more manpower, which sometimes exceeds the already high budget. Teaching students film making through this method are not ideal in many cases, first of all, this requires more time and manual effort, secondly this method is expensive, which is the leading cause of higher fees at those film schools and universities that use traditional production methods to teach their students.

On the other hand, digital production does not require specific location or venue. Moreover, unlike traditional production the sub-stages in this method do not require different workspaces, and also this process dramatically reduces physical efforts and the need for manpower. After finishing the shooting, all the major processes are completed on the workstations. Digital production is an efficient method and its ideal to teach students with, because students nowadays are more familiar with graphic user interface [GUI] based computer applications. Thus, the digitization of the traditional production made it easier to learn faster and in more efficient way. Some more comparison between traditional media and digital media systems and equipment have described below [2].

2.1 Film Editing

Film editing is the part where editors join different scenes of the footages in sequence and removes/remove the unwanted scenes; through this process the film becomes more understandable and cohesive. Non-linear editing was not invited by everybody and numerous editors opposed the new wave. Also, the early advanced video was tormented with execution issues and instability. However, the upsides of non-linear video inevitably turned out to be overwhelming to the point that they could not be overlooked (the process of non-linear editing system is shown in Figure 6.)

In the 21st Century non-linear picked up strength and linear editing headed towards obsolescence. By this time the portrayal "non-linear" got gradually surrendered as it was no more fundamental—every editing was now computerized, and the "non-linear" angle was accepted. Linear was dead. Similarly, students learn the digital audio process via software such as Pro Tools, Adobe Audition, and Audacity. They get first taught about the digital waveform and then moved to editing part. Processing audio on computers is simpler as compared to audio mixing on traditional equipment, which is not ideal for students, especially for the beginners (the process of linear editing system is shown in Figure 5.)

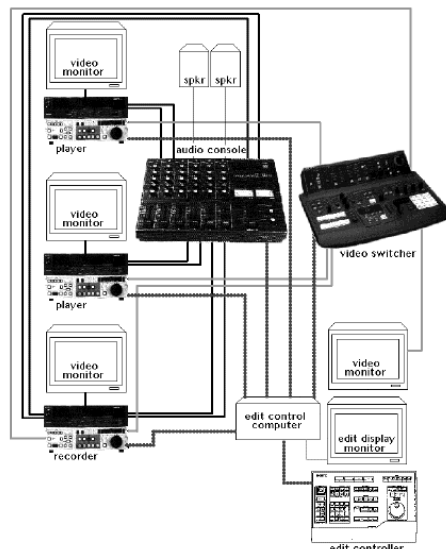


Figure 5. Linear Editing System [3]

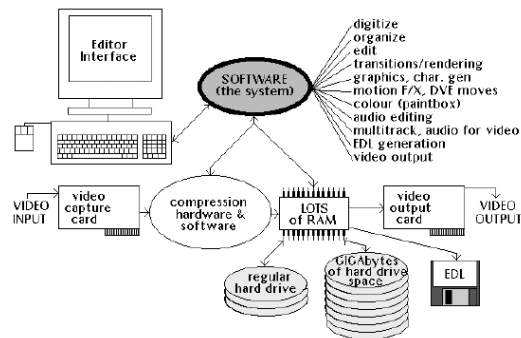


Figure 6. Non-linear Editing System [3]

2.2 Cameras

The nature of computerized photos can get measured in a few ways. Pixel tally is ventured to associate with spatial resolution. [4] Some picture components (pixels) in the image sensor get checked in millions and called "megapixels" and frequently utilized as a figure of legitimacy. Advanced cameras have a variable relationship between last yield picture determination and sensor megapixel count. [5] Other elements are vital in computerized camera determination, for example, the quantity of pixels used to determine the picture, the impact of the Bayer model or other sensor channels on the computerized sensor and the picture preparing calculation used to insert sensor pixels to picture pixels. Computerized sensors are for the most part orchestrated in a rectangular framework example, making pictures helpless to moire example ancient rarities. The film did not get influenced by moire due to the irregular introduction of the silver salts in its emulsion; the presence of its silver salts regularly called, "grain"[5].

The determination of film pictures relies on the zone of film used to record the picture (35 mm, Medium Organization or Large arrangement) and the rate. Evaluations of a photo's determination brought with a 35 mm film camera shift. More data may be recorded if a fine-grain film, consolidated with an exceptionally figured engineer, are utilized. On the other hand, utilization of low-quality optics or coarse-grained film yield lower picture determination. A 36 mm x 24 mm edge of ISO 100-rate film was first assessed to contain what might as well be called 20 million pixels, [6] despite the fact that this evaluation got later reconsidered to somewhere

around 4 and 16 million pixels relying upon the kind of film used (the comparison of Film and Digital Camera is shown in Figure 7.) [7]



Figure 7. Comparison of Film Camera (left) and Digital Camera (right)

2.3 Color Grading/Color Correction

Color grading or color correction is the process where footage's raw colors are stylized and altered according to the theme of the film. The color grading was introduced when films got moved from black and white to colours.

In the traditional film production, the footages were stylized through the photochemical process, which was sensitive, expensive and lengthy because this process got performed in laboratories that had to be setup with best-maintained equipment. Later this process was moved from photo-labs to hardware-based colour correction; this got called as the second phase of traditional colour grading/correction process. On the other hand, digital film process uses software-based color grading/correction method (as shown in Figure 8); this process got entirely performed on workstations using different available software.

Hardware based process (da Vinci 2K, Pandora International MegaDEF) have truly offered better execution and a littler list of capabilities. The constant execution got upgraded to specific determination and bit profundities dissimilar to software-based process that utilizes standard PC industry equipment and frequently exchanged speed for determination freedom. Nevertheless, software-based colour grading/correction process tends to have more elements, for example, spline-based windows/masks and advanced motion tracking (as shown in Figure 9.) [8]



Figure 8. Control panel-based colour grading, where the user works on costly equipment to colour grade/correct the film project.



Figure 9. Software based color grading does not require any additional equipment. This process can perform on a laptop or high-end workstation. This process allows the user to work entirely on single software.

3. TEACHING DIGITAL FILM PRODUCTION'S STAGES

3.1 Development

In this phase, students mainly focus on the theoretical part before moving to practical. Initially, they are taught how a task producer selects a tale, which may come from a Word of God, play, another motion picture, true story, video game, comic book, graphic novel, or an original idea. Students then continue to learn the next steps, which are identifying a topic or underlying message, in this step producer works with writers, to prepare an outline. From this step, students start working on computers and learn outline-creating tools, such as Final Draft. The Middle Eastern students are keen in

adopting latest technology; therefore the teachers do not face difficulties while introducing these applications.

After the introductory part, students are assigned tasks. For example, they produce an outline, which breaks the story down into a one-paragraph tantrum that dressed are on dramatic structure. Then, they prepare a treatment, a 25 -to-30-page description of the story, its mood, and quality. This stage usually has little dialog and stage way, but often contains lottery that help visualize key spot. Another way is to produce a script once a synopsis gets produced. These whole process students perform on screenwriting tool; the most common tools are Final Draft, Adobe Story, and Movie Magic Screen Writer. These tools are ideal for teaching because of its simplicity and language control. Middle Eastern students often face difficulties in languages, which are different from their home language. Therefore, it has ideal to teach them advanced screenwriting tools but based on simple GUI.

Next step that students learn is how a screenwriter writes a screenplay over a full point of several months. In the traditional film production, the screenwriter may rewrite it several Synonyms (Ordered by Estimated Frequency) of noun time to improve dramatization, clarity, structure, characters, dialogue, and overall style, which requires more time and paperwork. With the help of screenwriting applications, the screenwriters can finish their tasks much faster and accurately, software such as Adobe Story acts as a catalyst in terms of screen and script writing, the user interface of Adobe Story can be see in Figure 10. Working on papers consumes more time, whereas using applications helps the screenwriter in many ways because in these tools the screenwriting terms are already built in and the writer only drag and drop it on the desired location. [9]

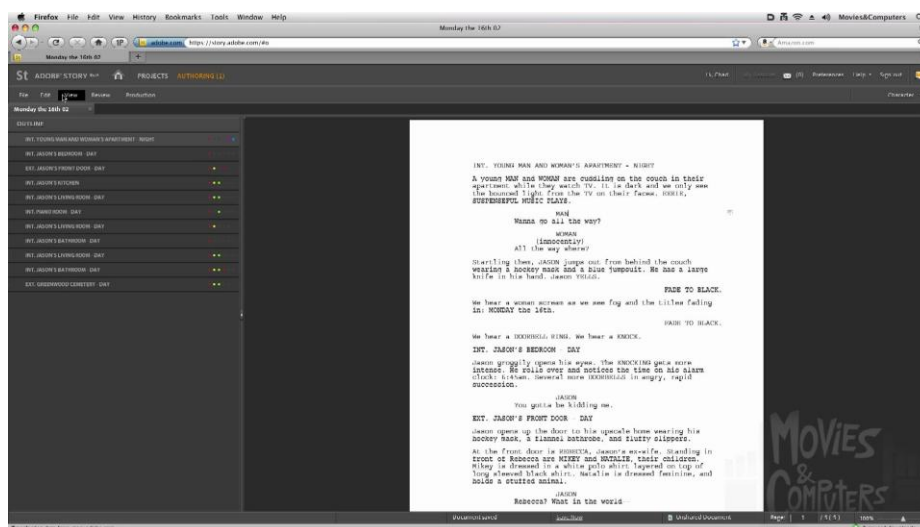


Figure 10. “Adobe Story” graphical user interface

3.2 Pre-Production

In pre-production, students learn how each progression of commercially making the film is precisely composed and arranged. In traditional film production, the generation organization is made, and a creation office is set up, whereas, in digital film production, there is no requirement of establishing specific organization or office, with the help of digital technology the whole process can get performed on one or more workstations. However, the trend of entrepreneurship in the Middle East often attracts students to start their studio in the end. The film is pre-imagined by the executive, and storyboarded with the assistance of artists and idea craftsmen, this step has become simpler due to the invention of collaborative storyboarding tools, which can get installed on smartphones, tablets or desktops, and can be shared with the storyboard team over the cloud. Tools like Articulate Storyline, Celtx, Story Board 3D, and Paper by FiftyThree (the user interface of FiftyThree can be seen in Figure. 11) are widely used in teaching and commercial filmmaking. Tablets and smartphones are best choice to install these tools because it's handy, and offers smart features like stylus pen drawing, and generating storyboard illustrations by taking photographs through the device camera [38].

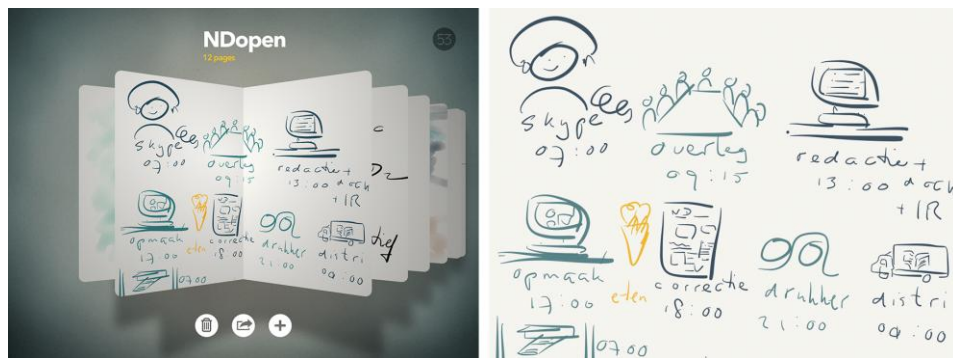


Figure 11. A storyboard example drawn on “Paper by 53” on tablet.

3.3 Production

In this stage, the video is shot, and audio is recorded. In the traditional film production process, the video is shot on film cameras, which is complicated to use due to its independent technical parts, and cost of development of film and maintenance. On the other hand, digital cinema cameras are simpler to use. The digital cinema cameras are available from high-end to low-end; DSLR cameras can be used as the cinema camera also. The cost of digital cinema cameras is much lower, and these are widely available in the

Middle East region. Students get their hands on the cameras during their second level. They are given sound knowledge of traditional cameras, so that can understand the concept of lenses and recordings. The traditional film production follows the re-recording process to record sound. Re-recording is the procedure by which the soundtrack of a movie or video generation gets completed. As sound components are combined and consolidated, the procedure requires "re-recording" the greater part of the sound components. For example, dialog, music, sound impacts, by the sound re-recording mixer(s) to accomplish the wanted deciding result, which is the last soundtrack that the gathering of people hears when the completed film is played. In the contrast, digital film production follows digital audio recording process. Digital sound recording procedure is valuable in the recording, control, large scale manufacturing, and dissemination of sound. Cutting edge online music dispersion relies on upon advanced recording and information pressure. The accessibility of music as information records, as opposed to as physical items, has altogether decreased the expenses of distribution. [10]

3.4 Post-Production

Here the video/film editorial manager gathers the video/film. The shot film material is altered. The recorded sound (dialog) gets additionally altered; music tracks and melodies are formed and recorded for film score; sound impacts are planned and recorded. Any computer-graphic visual effects get digitally included. In the end, every single sound component is blended into "stems", which are then hitched to picture, and the film is finished ("bolted"). In this stage, the computers get heavily used, and the most important phase to teach students. After shooting the video, students are trained to edit their video and audio files. In the video editing part, students' gets their hands on computer based editing; know as "non-linear editing". Non-linear editing uses tools such as iMovie, Final-Cut Pro, Sony Vegas and Adobe Premier.

At the beginning of electronic video creation, linear (tape-to-tape) editing was the best way to edit videotapes. At that point, in the 1990s, non-linear editing PCs became accessible and opened an entirely new universe of editing force and adaptability.

4. ADVANTAGES

4.1 Shooting on Digital Cameras

Digital Camera Recording or Video is spreading rapidly. As innovation develops, the video will soon turn into the business standard, due to business friendly nature of Middle East region, students are more tend to adapt the latest technology and are keen in learning them. It has difficult to know when, however, the push towards it has started. The principle

motivations to pick video are 1) work process, 2) cost, and 3) reproducibility [11].

4.1.1 Work Process

Video can truly speed things up. With film, preceding the shoot, somebody needs to stack the magazine in a light-safe zone. After the shoot, the film must be produced, handled, and digitized (transformed into a computerized document in a PC). The film gets digitized because most altering is presently done in PCs, utilizing projects like Avid or Final Cut Pro.

On the off chance, that user shoots video; the user can avoid these strides. User record straight into an SD card or hard commute. The footage is then emptied in a PC or separate hard drives. The footage does not need to be prepared; the user can watch it on the set within seconds subsequent to taking it.

Another advantage; particularly in the middle east regions is that, the film on the traditional cinematic cameras have to be loaded and used on camera under the pleasant weather, and due to hot and humid weather of Middle East, there are fair chances of camera film to get raptured. Students will not feel comfortable or motivated while working long hours in this kind of weather, as traditional film requires more time and effort to capture footages.

4.1.2 Cost

Shooting film is costly. A 400-foot part of 16mm stock expenses about \$100. 400 feet of 16mm film is sufficient for 11 minutes of footage. That implies that, when shooting 16mm, user burn through \$100 for every 11 minutes. However, highlight movies are shot on 35mm, and they shoot path more than only two hours of footage. With the help of SD cards media, the storage media can be utilized perpetually again and again in distinctive activities.

4.1.3 Reproducibility

The video is likewise helpful on account of its reproducibility. Much the same as documents in users are PC, the video is computerized, and so it can be cheaply duplicated again and again with no misfortune in quality at all [12]. Moreover, one of the drawbacks of recording on film was the restoration factor, for example, it was almost impossible to restore any damage film. However with the help of digitization such issues were resolved in the less amount of time [30][32-33].

4.2 Non-Linear Editing, Computer Based Editing

There are numerous favourable circumstances a nonlinear video editing system presents. To begin with, it permits user access to any frame, scene, or even collection of scenes at any time. Additionally, as the first video footage gets kept in place when editing, users have the capacity to come back to the first take at whatever point they like. Furthermore, the nonlinear video editing system offers the adaptability of editing. The user can alter user's opinion a hundred times over, and changes can likewise be made a hundred times over without needing to start from the very beginning again with every change. Thirdly, it is likewise conceivable to edit both standard definitions (SD), and high definition (HD) show quality recordings rapidly on typical PCs that don't have the ability to do the full preparing of the tremendous total quality strong determination information continuously.

4.3 Software Based Color Grading/Color Correction

Hardware driven colour correction process is highly expensive. Also the training process is lengthy due to hardware complexity, particularly in the Middle East region, because the overall region is adapting latest technology with the immense slow rate. The Middle Eastern students are highly capable of learning software based systems rather than hardware due to its flexible nature. The software-based process of colour grading/correction is faster, and the results get produced spontaneously. The simplicity of its GUI makes it easier to understand. Therefore, users with no knowledge of colour grading/correction can get their hands on quickly and results are fascinating. The lighting is an essential part of colour grading and colour correction, lighting enhances the look of the colours and gives a film an overall look and feel. In the non-digital filmmaking, the results are not seen on the spot because they are recorded on films and can be viewed only after developing it, therefore this consumes huge amount of time and some times it ends up with many errors. However, the digitization of film production has enormously enhanced the lighting techniques by introducing new sources and software based lighting controls [31].

4.4 Digital Audio Recording

One extraordinary advantage of digitally recorded sound documents is their sturdiness. While tapes can physically break and frequently experience the ill effects of contorted or mutilated tape, advanced records can be put away for quite a long time with none of these issues. The sound nature of advanced records does not decay after some time or when duplicates get produced. While tapes get constrained to 60 or an hour and a half in span, computerized documents can be of any length. It is likewise far less demanding to alter advanced documents and to include exact timestamps for parts that are indiscernible or misty. This digital process helps the customer in that it gets to be far less demanding to ensure precision in the recording.

One more of the greatest changes gave by advanced recording is it's to the point nature with which documents can get traded between the customer and the sound designer. Advanced documents can be sent using a safe transferring administration over the Internet. This method is to a considerable degree helpful for clients who are occupied or travel every now and again because there is no more need to come back to the workplace or to endeavour to discover a mail station to send sound documents. All that is required is a suitable PC and Internet Association. Correspondingly, the sound designer has the capacity email or transfer finished transcripts of computerized records to the customer, before erasing the first documents. These advancements spare time and uproot postage costs while all the while killing the danger of valuable documents being lost or harmed via the post office.

4.5 Digital Video

Not similar to different feature groups, which gets shown in regards vertical determination (for instance, 1080p, which will be 1920×1080 pixels), advanced silver screen formats are normally specified As far as level determination. Likewise shorthand, these resolutions need aid every now and again provided for to "nK" documentation, the place n is the multiplier from claiming 1024 such-and-such the even determination of a relating full opening, those digitized novel into a film outline is unequivocally $1024n$ pixels. Here the "K" need a standard, which implies thinking about of the double prefix "kibi" (ki) [13]. For example, a 2K picture is 2048 pixels wide; also a 4K picture may be 4096 pixels totally. Vertical resolutions contrast for viewpoint proportions. However, a 2K picture for a high definition television (16:9) viewpoint extent is 2048×1152 pixels, same time a 2K picture with an SDTV or Academy extent (4:3) may be 2048×1536 pixels, what's more you quit offering on that one with a Panavision extent (2. 39:1) might a chance to be 2048×856 pixels. Due to those "nK" documentation not comparing on specific Indeed going resolutions for every position a 2K picture lacking, for instance, the standard 35mm film soundproof space, is only 1828 pixels wide, with vertical resolutions rescaling Likewise necessities would. This digitization incited a a lot from claiming movie-related feature resolutions, which may be really puzzling What's more habitually tedium With respect to these days couple projection measures.

Knowing that many formats intended for advanced cinematographer will be progressive scan, and as a rule, this happens toward the same 24 frames for every second rate built Likewise those standard for 35mm novel into a film. Some movies for example, The Hobbit: An Unexpected Journey have span rate about 48 fps, Despite over exactly theatres, it got discharged for a 24 fps versify that Numerous fans for conventional film incline toward. Those

dci standard to cinema, Likewise a rule, relies for a 1. 89:1 viewpoint proportion, In characterizing the best compartment extent to 4K Concerning illustration 4096×2160 pixels What's more 2K Likewise 2048×1080 pixels. At those side of the point At flowed as a advanced cine-film one bundle (DCP), content may be letterboxed or mainstay boxed Concerning illustration fitting on fit inside a standout amongst these compartment formats [14].

5. CHALLENGES

There are many challenges in terms of digital filmmaking. For example, the commercial market is not on the peak at the moment, the Middle East region do not have a full-fledged filmmaking industry, and limited systems available in Middle East that crashes every now and then. These challenges are further discussed in details.

5.1 Commercial Market

Cheaper computerized film production systems had aided in making more item than purchasers. In the end, the graduate students are expected to make money out of their films, but if these facts stay for long, students might not be able to grow in the field, and not even continue in the area as an independent filmmaker. Even though the commercial market is saturated at the current stage, there are bright chances of the digital film market to grow dramatically in the future [35-36].

5.2 Setting up filmmaking as an industry in the Middle East region

There is no doubt that public in Middle East region goes to the cinema, to watch movies on regular basis. They are more interested in watching Hollywood or Bollywood productions; therefore whenever there is a local film released, it gets fairly low exposure. Hence, the producers do not make any money out of it. This situation is all due to lack of talent in the field of local cinema. Thus, teachers go through arduous efforts while teaching students of this region.

5.3 System Crashes

One of the most common challenges that filmmakers and teachers faces are the system crashes. Even though this does not happen frequently, the filmmakers and students feel frustrated when they lose their files due to low maintained PCs or power failures.

6. CONCLUSION

After analyzing the innovation of Digital Cinema, it is evident that advantages of it outweigh the challenges. For many years, students of Middle East wanted to learn the filmmaking, but due to limited resources of traditional film production, there was always a shortage of teaching staff and equipment. However, introducing the digital film production to the

students, made a huge difference. It not only helped students to learn the filming process much faster and efficient way, but it also enhanced and improved the local cinema.

7. FUTURE SCOPE

There are bright chances of full-fledged cinema industry to be developed in Middle East region soon. As more film students graduate, they will join the field and contribute to the industry on an advanced level. Knowledge management helps to collect, store and archive historical films which can strengthen the field of Artificial Intelligence (AI). Digitizing film industry integrated with AI [15 – 21] can bring exponential growth in film industry, especially in Middle East region.

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