ASSESSING THE COMPETENCY OF HIGH DYNAMIC RANGE TECHNIQUE IN ARCHITECTURAL PHOTOGRAPHY

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Abstract

In photography field although there are number of categories, the category of architectural photography takes a unique place among the other categories because in architectural photography the abiotic subjects are represented as an artistic way. However, when capturing architectural subjects, photographers face many problems such as lighting issues, lack of dynamic range etc. that eventually reduce the quality of the photograph. Although the technique of High Dynamic Range (HDR) is introduced to minimize the above problems in other photography categories, in architectural photography this technique is not widely used because of some hollow sentiments of architectural photographers.

By conducting the questionnaire, it was identified that most of the architectural photographers are not aware about the benefits of the HDR technique. Also, from the practical session it was observed that the architectural HDR photographs are more useful than the ordinary photographs because in HDR photographs the colour depth, dynamic range and the details of the architectural structures are well captured than the ordinary photographs. The results of this study proves that the HDR technique is suitable to capture the architectural photographs because it helps to resolve the problems which photographers face mainly due to the lack of dynamic range.

Keywords: Architectural Photography, Low and High Dynamic Range technique, Bracketing

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Introduction

High Dynamic Range (HDR) technique is a photographic technique, which is used to overcome the dynamic range limitations of the ordinary single shot photography. Generally this technique is used in the creative photographic purposes. However, this technique cannot be used in every photographic form because of some technical limitations. HDR technique can only be used for some still subjects such as buildings, vehicles, some still sceneries of the nature etc. As a photographic form, this technique is used in Architectural photography and Landscape Photography. By using HDR technique when shooting high contrast sceneries, creative and quality results can be obtained. Therefore by choosing correct photographic subjects, the photographers can get better results and extended dynamic range photographs from the HDR technique.

After the development of the digital technology, this technique was introduced to the photography field and it became very popular among photographers because it helps the photographers resolving some problems such as lack of dynamic range, lack of details of the photographs and several lighting issues which they face while shooting subjects. However, the usage of this technique is only limited to some special photography forms such as Landscape Photography, Architectural Photography etc.

In architectural photography, photographers do not use this technique very effectively to resolve their problems. Lack of dynamic range is one of the major problems in architectural photography. Since the camera does not have a high dynamic range as the human naked eye, photographers find it difficult to capture all the details of the structure and the existing lighting condition into the photograph. Therefore the photographers are failed to capture the Black, the White and the shades of the Black and White differently from each other. This situation is occurred due to the lack of capability of the camera to have a high dynamic range. HDR technique has been introduced to resolve that problem. By using HDR technique,

"Very dark and bright areas of a scene can be recorded at the same time in to an image or a video, avoiding under-exposed and over-exposed areas" (Banterle et al.) (2009, p. 2)

Architectural Photographers are mainly dealing with the ambient light. Therefore, they cannot adjust the light as they wish while shooting. Especially in exterior architectural photography, the photographer cannot move the subject and the main light source.

In exterior architectural photography, the main light source will be the sun or the streetlights. Photographers cannot use artificial lights such as flashes. Therefore, HDR technique is a proper method to shoot the structures under the ambient light because it has the solutions to the most of the questions, which are faced by the photographers when shooting under the ambient light.

When the photographers shoot interior subjects in architectural photography, they can use some artificial lights such as flashes. However, due to the lack of dynamic range of the camera

they have to use many flashlights. However, that will lead to many lighting issues. Therefore, if a photographer wants to control the dynamic range in interior as well as in exterior at once, he has to face many problems. Because the photographer cannot set the correct exposure, the photograph will be under exposed or over exposed. To manage this issue photographers can use the HDR technique very easily and take a good and artistic photograph without putting much effort to do the lighting.

However, there is no scientific background and a proper method to use the HDR technique in architectural photography. Some photographers claim that HDR technique is not suitable for the architectural photography because sometimes it distort the true scenery.

" The most cumbersome of these debates has centered around the use of high dynamic range (HDR) photography. Many so-called 'purists' refuse to acknowledge it as a form of photography at all. Their argument generally centers around the supposed lack of reality within HDR photographs. A purist definition is that photography should be the 'accurate representation of the life'."(Mclntyre) (2012, p. 3)

The High Dynamic Range Technique

As the technology advances in an accelerating speed, new developments to the photography field have been evolved enhancing the facility to obtain better quality photographs. Due to the improvements of the technology, the boundaries of the photography field have been expanded embedding more realistic approach to the photographs.

The best example for that kind of an improvement is the High Dynamic Range (HDR) technique. This technique has a high potential to improve the existing quality of the photographs to another level in the future and many existing researches have been conducted to assess the competency of HDR technique.

According to Ross Hoddinott (Hoddinott 2013) HDR technique is a software technique, which is used to avoid dynamic range limitations of the digital camera. As he states a HDR photograph can produce more shadows and can highlight details better than an ordinary photograph. Therefore, he points out that the HDR technique can be used to extend the dynamic range of a photograph and to creatively produce artistic, surreal and artificial moods in the photograph (p. 180). And also Luigi Barazzetti (Barazzetti 2014) stated that the High Dynamic Range technique gathers complete dynamic range of the light of the subject and it also can increase the radiometric quality of the photograph (p. 141).

In an article of a world famous photographic magazine "digital photographer", the HDR technique is described as the procedure of capturing several exposures of the subject and merging it in to a single image. According to that particular article written by Chris Humphrey's (Humphreys 2014), HDR technique can be used to capture a scene as natural as a human naked eye. But he further describes that the photographer must choose an ideal subject for the capture in order to get a better result using the HDR technique and the scenery

which is suitable for the HDR photography should be a high contrast and diverse composition which cannot be captured from a traditional single shot photograph (p. 46).

According to Zifeng Wei (Wei 2012), HDR photography is a digital process which merge two or more exposures in to a single image to capture dark and bright areas of the scenery. He further describes that the contrast ratio of the human eye as 16384:1 and from that digital camera records only 2048:1. Contrast ratio of the film negative is below than digital camera and is 128:1. Therefore, according to his view, only HDR technique can be used to capture a contrast ratio, which is close to the human eye, and it is the only one solution, which is available to map the real scene's contrast ratio to the single image (p. 11).

Dynamic Range

In the field of photography, the photographers have to face number of technical limitations while shooting subjects. Among those problems, dynamic range limitation of the camera sensor is considered as the most serious problem and therefore many researches have been conducted about the dynamic range. Also some methods have been invented to extend dynamic range of the photographs. As a result of those methods, HDR technique has been invented as a better approach to solve the dynamic range issue. But to achieve better results by the HDR technique, photographers must have a sound knowledge about the dynamic range and how it is used in different scenarios to enhance the quality of the photograph.

According to Ross Hoddinott (Hoddinott 2013) although dynamic range is a common term which is used to define the difference between the highest value and the lowest value of a certain valuation, in the field of photography dynamic range is defined as the variation of the highlighted areas and the darkest areas of an image. Also he states that due to the technological development of the modern world, the type of the camera and the intensity of its sensor has become the main facts which decide the dynamic range of a photograph taken by a digital camera.

He considers camera as a representation of the human naked eye and believes that the inventors have studied and followed the process of the human eye when making the camera. When focusing on the dynamic range, he points out although the human eye has a very wide dynamic range which helps to distinguish the variation between the dark shadows and the brightly lit areas with a great speed and a good accuracy, the sensor of digital camera is unable to do that process as efficiently as the human eye. By using that argument, he points out that the sensor of the digital camera has a narrow dynamic range relative to the human eye.

Therefore, the camera is not capable to record all the data of a high contrast image. Not only the sensor and the processor of the digital camera effects the dynamic range, but also it is affected by the file format of the image saved in the camera. So Ross points out when a photograph is saved as a RAW image format, it contains wider dynamic range than in a similar JPEG file.

The lack of dynamic range in digital cameras has become a big challenge to the photographers especially when capturing high contrast images. As a result of that capturing an image that shows the true lighting condition has been a difficult procedure. In order to resolve this problem, according to Ross some photographers follow some contraptions such as using filters and exposure bracketing by merging them during the post processing. But as he points out although every photographer has experienced some difficulties regarding the dynamic range, only few of them have tracked the real reason for those difficulties.

In digital cameras, the lighting condition is measured and converted to a digital code by the bit depth. The Ross considers the number of bits, which is used to indicate the colour of a single pixel, as the bit depth. That means the quantity of the light, which is absorbed to the sensor of the cameras, is converted to a numerical value by an analog to digital (A/D) converter. Most of the modern DSLR cameras have 12 or 14 bit sensors. Ross says that only the RAW file format can have a higher bit depth since the JPEG file format always limit to 8bpc. However, when the photographer needs to get high dynamic range images, Ross points out that the 12 or 14 bit depth is not adequate. Especially when capturing highlighted areas and the dark shadows at once, photographer has to face this dynamic range problem.

To resolve this problem various contraptions are using by the photographers. Sometimes using ND filters before the lens is the most famous contraption as Ross to resolve this dynamic range issue. But photographers should find the most suitable ND filter to capture the photographs because there are several kinds of ND filters used in the photographic field to capture different scenarios. Therefore as the Ross states if the photographer does not have a suitable ND filter it is impossible to manage the dynamic range as he wish.

And also there is another widely used contraption to get a high dynamic range image as stated by Ross. It is the high dynamic range technique. This technique is popular among the photographers because of its user friendliness and the time saving properties. HDR technique is a solution for the photographers to resolve many of their problems related to the dynamic range.

When using this technique, minimum three photographs are taken in different exposures. Then the captured different exposure images are merged when editing. Then the merged image is developed as a HDR image in the post process.

Because of the technological advancements, dynamic range of the camera sensors will be developed and increased in the future. Therefore, the usage of filters and exposure bracketing to capture high dynamic range images will be outdated. But the dynamic range is always bound with a photograph and therefore getting awareness of dynamic range and the methods to handle it, will be a good way to capture a good quality photograph. (pp. 28,29)

Tools and Techniques of HDR

HDR technique is a very useful technique to the photographers to extend the dynamic range of their photographs. Therefore, photographers have to follow some simple methods in order to take a HDR photograph.

Bracketing

Bracketing is the most important step in the HDR technique. In order to produce HDR images, the photographer needs to have differently exposed multiple photographs. For that purpose photographer should know about bracketing and its utility. Ross Hoddinott (Hoddinott 2013) has explained about exposure bracketing in his digital exposure handbook. According to Hoddinott bracketing takes many photographs of different exposures in a subject or a scene. The expectation of bracketing is to take correct exposed photograph among differently exposed photographs. Usually the photographer takes only one frame of a subject and always uses recommended light settings of the camera.

However, according to Hoddinott it is difficult to shoot correct exposure in some time and the solution for that problem is shooting bracketed sequence. Bracketing also can be done by manually. However, most of DSLRs have automatic bracketing system. This feature is very useful to the photographers to select correct exposure from multiple photographs, which captured from exposure bracketing. Hoddinott also has stated in his book bracketing is an essential and consequential feature in DSLR camera. Bracketing is no need to use for every capturing moment, but this feature is very useful to capture photographs which difficult to determine correct exposure. According to Hoddinott in film era bracketing was a substantial work. Because in those days photographer could not preview photograph until it process. Therefore, most suitable way for capture correct exposed photograph was exposure bracketing. Also exposure bracketing is always useful for beginners who entered to the photography field. According to Hoddinott in present day due to development of technology bracketing is not essential and many features such as histogram and post processing methods has been added to the digital capture. However, bracketing can be use for quick shoots and it will give perfect results by taking multiple photographs. (p. 59)

Using Tripod

Tripod is very essential equipment for HDR photography. HDR technique is using for extend dynamic range of the photograph and for that purpose multiple photographs should be taken and merge it via software. Therefore, those multiple photographs must be on same frame and should be used tripod for take stable photographs.

Rick Sammon (Sammon 2010) has stated shake of the camera is not suitable for HDR, because all photographs which taken of the scenery should be on same frame. Therefore, using tripod is the best and ideal way for avoid camera shake. Some times photographers have to shoot in

slow shutter speed and its impossible to shoot in hand held. And also, when merging photographs via software such as Photomatrix Pro, photographs must be on same line. (p. 53)

Shoot in Aperture Priority Mode

Aperture priority mode is also another factor, which needs to be considered when focusing on the HDR technique. Aperture priority mode was first introduced to the cameras after the digitalization of the photography field and now it has become one of the main methods in the domain of the HDR technique.

As defined by Rafael (RC 2011) a HDR photograph can be considered as a series of images that vary based on the exposure basically from the really under exposed to the really over exposed. According to him, there are several methods, which are used in changing the exposure of the series of images of a HDR photograph. He names those techniques as changing aperture, adjusting the shutter speed and adjusting the ISO. Further he states that these images should be taken in Aperture priority mode because of the capability of the Aperture priority mode to control the depth of field of the images. (p 11)

Spot Metering

Spot metering is a type of metering system. In photography field, metering system is considered as a way that measures the light to determine the best exposure value for a particular scene or a subject.

Therefore, the spot metering can be defined as a system, which calculates the exposure of the photograph by only considering a small portion of the scene. Because of this characteristic, spot metering is considered as the best metering system for the HDR photography. (Hoddinott, 2013, p. 22)

Shoot in Raw

HDR technique is used to take wide dynamic range images. For the purpose of obtaining a wide dynamic range image, multiple photographs that contain all the information about the scenery should be captured.

Generally raw file format contains all the information about the scenery. Therefore for the HDR technique raw file format is considered as the best file format. Rafael stated that the raw file format is the best image format for the HDR or any other photograph work and it is similar to a negative.

The raw file consists of all the information of a scene and can be processed the information later when required. Raw files can be opened in photography software such as Photoshop, Lightroom etc and can be converted when processing. (RC, 2011, p. 13)

Shoot with Low ISO

Controlling the ISO is one of another important criterion in HDR technique. Generally in HDR images, the ISO is kept at a low level when capturing.

In HDR images, since several images are merged to create a single image digital noise is produced unnecessarily. Therefore when creating an HDR image, the level of noise increases with the number of images that are merging with each other. (Sammon, 2010, p. 51)

Post Production of HDR

As well as the image capturing process, postproduction process is also another important criterion in HDR images. As stated by Wojciech Toman (Toman) post processing of a HDR image is conducted using the following steps.

- Loading Bracketed Images
- Ghost Removal
- Merged HDR photo
- Tone Mapping Step
- Finishing and Saving

From the steps mentioned above mainly two important criteria are considered when conducting the post processing of a HDR image. Firstly, the differently exposed photographs are merged together by using photography software and then the merged image is tone mapped since normal displays are not capable of displaying HDR images with the actual quality. Therefore, HDR images are converted to LDR images by using HDR tone mapping process before the images are displayed in the conventional displaying devices. (Zhu 2013, 13)

Issues of the High Dynamic Range Technique

HDR is a very advanced technique, which is used in order to avoid technical limitations such as lack of dynamic range, lighting issues etc. occurred when capturing images. However, this technique also has some technical limitations and because of these limitations, some photographers do not use HDR technique as a practice. However, all of these issues can be solved easily.

Noise

Noise is considered as the major issue of the HDR technique. When using local tone mapping operators, it enhances the noise as well as the details of the image. To avoid the issue of the increasing noise two steps can be followed.

Capturing whole dynamic range of the scene. That means if did not capture the information of shadow correctly noise will be enhanced to the final image.

Another solution is using low ISO level for capture the scene.

Misalignment

This is another issue of the HDR technique. When the vertical and horizontal movements of an image have difference in multiple photographs final HDR image will be misalignment. To resolve this issue can be used good and steady tripod and remote shutter release.

Over saturated look is the major issue of HDR technique and many professionals reject this technique because of this over saturated look when producing HDR photograph via software saturation value become high. Therefore, photograph appears like surreal. So can be resolved it by adjust the saturation level of the image from software. In addition, some particular colours such as reds, Greens become over saturated in HDR images. To resolve the problem editing software such as lightroom can be used since the software reduces the saturation of the above colours.

Halo Artifacts

This issue is very common in HDR images and can be seen in boundaries of the two regions with different brightness. This issue can be solved by using the photo matrix pro software by decreasing the strength, lighting adjustment settings and increasing the smooth highlights. In addition, this issue can be fixed by using the burn and dodge tools in Photoshop.

Ghosts

Ghost effect is one of the main issues of the HDR technique. Generally HDR images are more suitable to capture abiotic subjects such as buildings, statues etc. However, sometimes there can be moving objects between the shot and the subject. Therefore, when capturing photographs, those moving objects might be registered on the image and after producing the HDR image the moving objects will be shown as ghosts on the HDR image.

This issue can be resolved using the HDR software such as photomatrix pro because this software has a feature to remove ghosts automatically or manually. (Toman, pp. 16,17,18,19,20)

Methodology

Since there are different sentiments among the architectural photographers, the first part of this study was conducted to identify the architectural photographer's opinions about using the HDR technique in architectural photographs by distributing a questionnaire among the architectural photographers.

In order to fulfill the above mentioned objective a questionnaire was prepared with seven questions. Six questions were designed as close-ended questions and one question was designed as an open-ended question.

The questions were designed to get a basic knowledge about the respondent's academic qualifications, the skill level of the architectural photography, and the skill level of the HDR technique and their opinion of using HDR technique in architectural photography. The respondents were selected from all around the world who are professional in photography. The questionnaire was sent them through the Internet and the data were collected using the "Google Form" Application.

The second part of the thesis was conducted to practically evaluate the competency of the HDR technique in architectural photography. Although professional architectural photographers were interviewed using the questionnaire, by doing the practical evaluation more acceptable results about the competency of HDR technique in architectural photography was obtained with verification. Therefore the main objective of this practical session was to capture architectural photographs using the HDR technique and without using the HDR technique in order to do a comparison.

The photographs were captured using the "Canon 7D" digital single lens reflection camera (DSLR). It consists of 18 Megapixel Complementary metal-oxide semiconductor (CMOS) sensor. The lenses, which were used in the camera, are 10mm – 18mm wide-angle lens and a 18mm – 200mm zoom lens.

The locations for the practical session were selected mainly by considering the objectives of the study. Since the main objective of this study is assessing the competency of HDR technique in architectural photography, archaeology structures from Polonnaruwa and Dambulla were selected to take photographs.

Archaeology structures contain sharp details and wide contrast of colours. Therefore when capturing ancient structures these sharp details and the true colours should be reflected on the photograph. Also there are so many restrictions such as using flash and artificial lights when capturing archaeology structures than the modern structures.

Ancient structures were selected to carry out the practical session of this study mainly because if HDR technique is proved to be competence when photographing ancient structures, it can be justified that HDR technique is also competent when capturing modern structures because modern structures do not contain much contrast like ancient structures. Also ancient structures have a very high photographic value because these structures become obsolescence day by day.

Also when selecting the locations, both the interior as well as the exterior locations were selected in order to identify whether there is any difference of the effect of the HDR technique based on the type of the location.

This is where the real HDR photograph is created. Therefore this process can be considered as the most important process in HDR technique.

When doing the post processing, "Photomatrix Pro 5. o. 5" software was selected to conduct the post processing because it is considered as the professional software for the HDR technique.

After created the HDR image it can be compared as follows.

Figure 1

Figure 2

Research Outcomes

The study was conducted by dividing two parts, one is Questionnaire and other one is Practical session. When considering about results of the questionnaire can be obtained as follows.

Outcomes of the Questionnaire

Questionnaire consisted of eight questions and first question was given to understand the educational level of the respondents regarding photography field. As shown in following figure 3 majority (around 67.6%) of the respondents are educated people about the photography. However, when observing the Figure 4, it can be observed that although most of the respondents are educated about the photography, they are not aware about the HDR technique or they are still novice to the HDR technique.
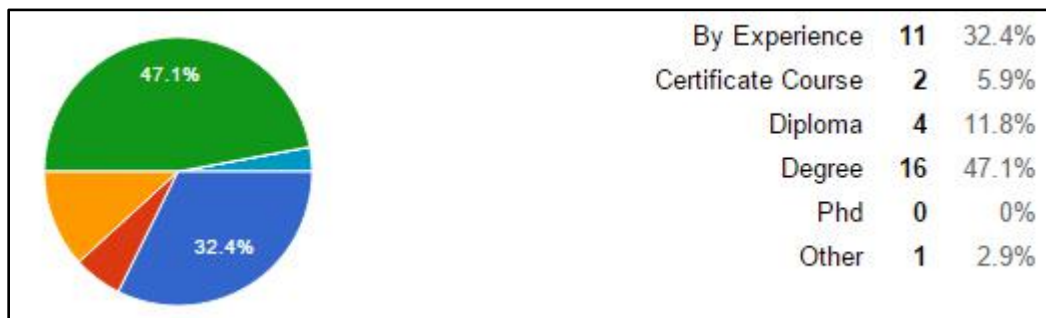

By Experience	11	32.4%
Certificate Course	2	5.9%
Diploma	4	11.8%
Degree	16	47.1%
Phd	0	0%
Other	1	2.9%

Figure 3

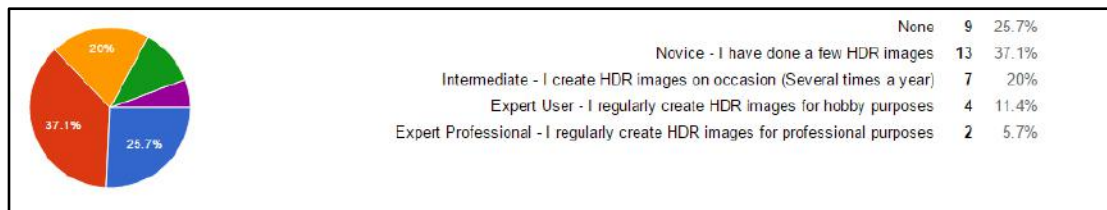|		
None	9	25.7%
Novice - I have done a few HDR images	13	37.1%
Intermediate - I create HDR images on occasion (Several times a year)	7	20%
Expert User - I regularly create HDR images for hobby purposes	4	11.4%
Expert Professional - I regularly create HDR images for professional purposes	2	5.7%

Figure 4

When observing Figure 5 it can be observed that although the respondents are photographers, most of them are not experts in architectural photography. This may be mainly due to rareness of the architectural photographers in a country like Sri Lanka because the photographers are not categorized according to the photography type.
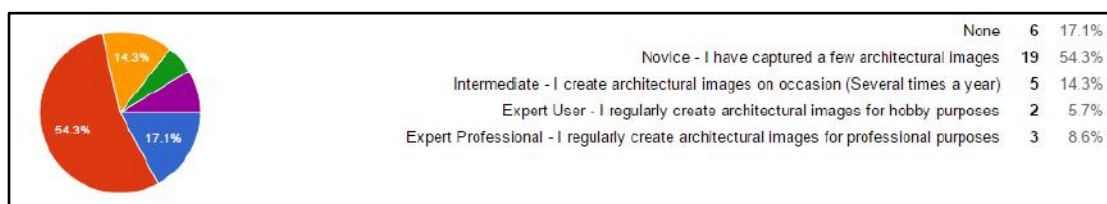

None	6	17.1%
Novice - I have captured a few architectural images	19	54.3%
Intermediate - I create architectural images on occasion (Several times a year)	5	14.3%
Expert User - I regularly create architectural images for hobby purposes	2	5.7%
Expert Professional - I regularly create architectural images for professional purposes	3	8.6%

Figure 5

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By observing the Figure 6 it can be seen that the majority of the respondents are not using HDR technique in architectural photographs.
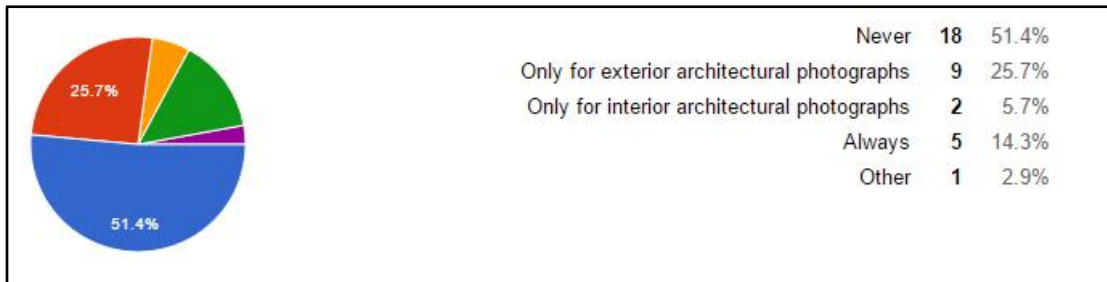

Never	18	51.4%
Only for exterior architectural photographs	9	25.7%
Only for interior architectural photographs	2	5.7%
Always	5	14.3%
Other	1	2.9%

Figure 6

By observing Figure 7 it can be seen that while some respondents are satisfied about the using HDR technique in architectural photography, the same portion of the respondents are not satisfied about using HDR technique in architectural photographs.

Very Satisfied	10	28.6%
Somewhat Satisfied	7	20%
Satisfied	7	20%
Not Satisfied	1	2.9%
No Idea	10	28.6%

Figure 7

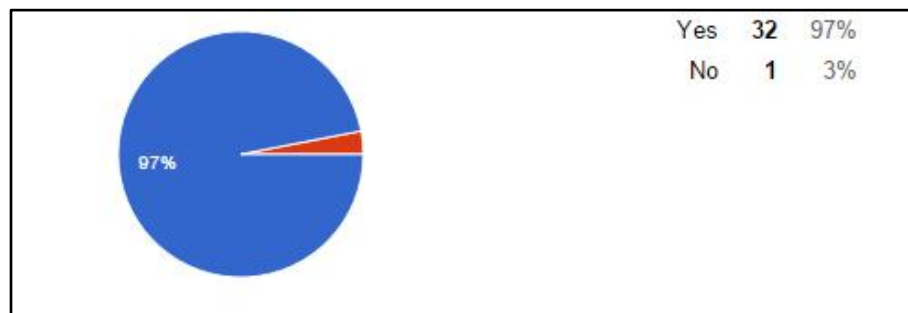|		
Yes	32	97%
No	1	3%

Figure 8

When observing the figure 8 unlikely in the other results, majority of the respondents have accepted the HDR technique as an art form. However, when referring the above results it was observed that most of the photographers are not using HDR technique for professional purposes and also for architectural photographs. Therefore, majority of respondents

accepting HDR as an art form is bit unlikely. Since photography is considered as an art form they might have considered HDR technique is also as an art form.

Outcomes of the Practical Session

Interior

Figure 9 and Figure 10 shows the ordinary and the HDR image of the Dambulla Golden Temple. The two images were captured under the same conditions including the lighting and the technical conditions.

Figure 9

Figure 10

But when compare the two images it can be clearly identified that the quality of the two images are significantly different. In addition, the HDR image has a more artistic look and a colour depth than the ordinary image.

Dambulla Golden temple consists of several caves and these two images were taken inside one of those caves. Also these two images were captured under a very low lighting condition because inside the caves the ambient light is very low and the rtificial lights cannot be used due to the archeology value of the paintings and the structures inside the cave. Therefore, in

the ordinary image the true colours are not visible due to the shadows. Also the mid tones of the real scene have not been captured in the ordinary photograph. Therefore, the colours of the ordinary image are slightly different than the real scene, which is visible to the human naked eye.

But, when considering the HDR image it has captured most of the shadows, mid tones and the highlighted areas of the real scene. Since the HDR image is a combination of the differently exposed photographs, it has the capability of capturing more colours and more details than an ordinary image.

Therefore, by comparing these two photographs it can be seen that the HDR image is more useful than an ordinary image under low lighting conditions.

Exterior

Lankathilaka Image House, which is shown by Figure 11 and Figure 12, has been captured as an ordinary image and a HDR image using the same frame in order to compare the two images uniformly.

When observing the ordinary image, a very dark look is visible because the mid tones and the shadows have been captured and highlighted. However, in the HDR image the dark look which is seen in the ordinary image is not visible and the subjects are highlighted than the shadows due to the wide dynamic range.

Because of the wide dynamic range of the HDR images, the highlights, mid tones and the shadows, which were captured, are blended to produce a highly artistic value and a photographic value. However, in ordinary images since this blending is not happening, shadows and the mid tones are highlighted reducing the artistic value of the photograph.

In the ordinary photograph, the statue, which is in the left tower of the Image House, is not clearly visible. However, in the HDR image, all the statues are clearly visible with all the details than the ordinary photograph. Also when comparing the colours of the two photographs, it can be clearly observe a difference between the colours.

In the ordinary photograph, the sky is shown in dark blue with no clouds. However, in the HDR image some clouds are visible. Although clouds were there in the frame when capturing the real scene, the ordinary photograph has not been able to capture these subjects. This implies that the HDR image can capture the scene more closely as seen by the human naked eye when compared with the ordinary images due to having a wide dynamic range as the human naked eye.

When observing the large Buddha statue, which is situated inside the Lankathilaka Image House, the bottom section of the Buddha statue is not clearly visible in the ordinary image when compared with the HDR image. This could be mainly because of the shadows. Although in the ordinary image that area is shown in dark black, in the real scene that area

was observed clearly with all the details and the correct colours from the human naked eye. In the HDR image, that area is captured as similarly as seen by the human eye. This again implies that the dynamic range of the HDR images is somewhat similar to the dynamic range of the human vision.
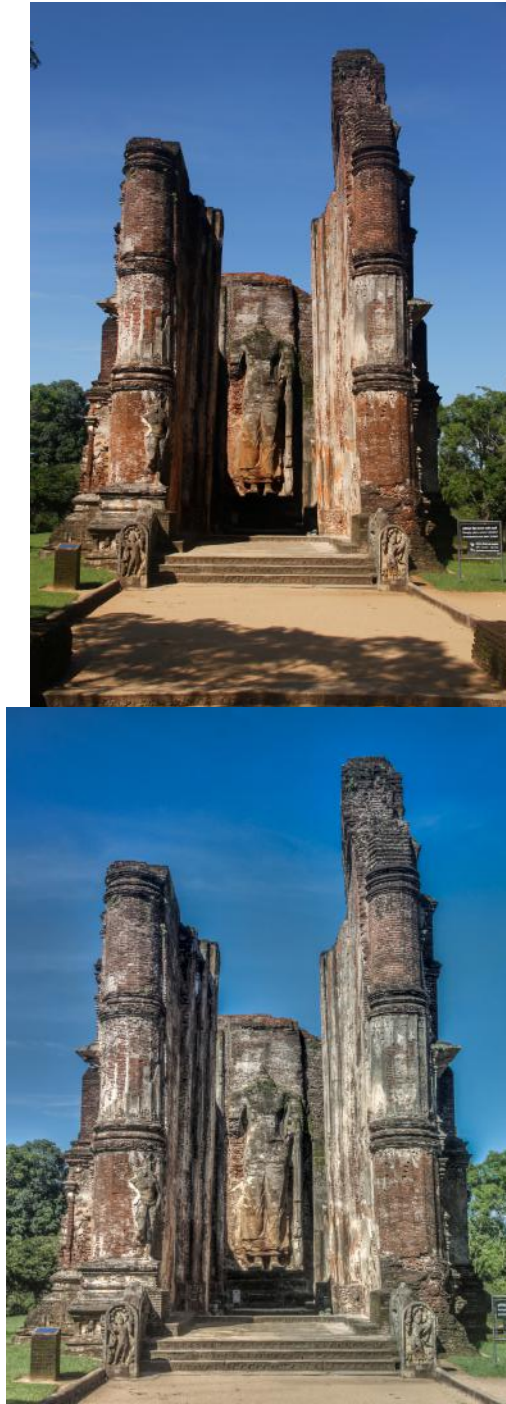

Figure 12

Conclusion

After the great invention of the digital technology, the world became digitalized instantly. Because of this great invention, as many fields were affected, the photography field was also converted to a new era. Because of this new era, new techniques and new equipment that were inline with the digital technology were introduced to the photographic industry in order to enhance the quality of the photographs and to make the task convenient to the photographers. Among the techniques introduced in this era, the High Dynamic Range (HDR) technique became very popular among the photographers immediately due to its good results.

HDR technique is used in the photography field in order to extend the dynamic range of the photograph. In the photography field, the dynamic range is considered as one of the most important factors to be considered when categorizing a photograph as a good and a quality photograph. But since in the digital cameras which are used in capturing photographs, the dynamic range is not enough, obtaining a photograph which contains all the details of the scenery is considered as a challenge to the photographers. As a solution to this problem the HDR technique was introduced and currently this technique is used in most of the digital displays and the mobile phones.

However, this technique cannot be used in all photography fields such as wildlife, sport etc. Due to the technical limitations of the HDR technique is only used when capturing abiotic subjects such as buildings, cars, sceneries etc. Therefore, this technique can be used in adoptable photography fields such as landscape photography, Architectural photography etc.

However, this technique is not popular among architectural photographers very much. However, architectural photographers can obtain good results by using this technique when capturing scenarios. Therefore, the main idea of this study is assessing the utilization of HDR technique in architectural photography, because some photographers claim that this technique is not suitable to the architectural photographs.

This study was conducted mainly under two methods. As the first method information were gathered through a questionnaire from the architectural photographers in order to get awareness about the usage of HDR technique in architectural photographs. As the second method, a practical session was conducted in order to identify the strengths and the weaknesses of a HDR image when compared with an ordinary image.

Practical session was conducted again under two sections. First section was conducted focusing on the interior architectural photographs and the second section was conducted focusing on the exterior architectural photographs. Dambulla Golden temple was chosen to capture the interior architectural photographs and the Polonnaruwa archaeology premises was chosen to capture the exterior architectural photographs. When capturing these photographs, three differently exposed photographs or in other words normal exposure, underexposure and overexposure photographs were captured in each scene without changing

the frame of the photograph in order to create the HDR image. Then an ordinary photograph was also captured in each scene under same conditions to compare the two photographs.

Then the photographs were imported to the computer and merged it using the software Photomatrix pro. By using the software the three differently, exposed photographs were merged for obtaining a single HDR image. Although the software produce the HDR image, since the computer monitor does not have the capability to show the real HDR image due to lack of dynamic range, the output from the software didn't not show the required quality. Therefore, the Real HDR image was tone mapped using the same software to obtain an image, which has a dynamic range that match, the monitor of the computer.

When comparing the photographs it was observed that all the HDR images have much more details than the ordinary images. Since the HDR images have wide dynamic range, it has captured all most all the details which can be seen by the human naked eye. In addition, in HDR images, the highlights, mid tones and the shadows of the scene are captured well and produce a variation of the colours with a great combination. Therefore, when considering HDR images and ordinary images, it can be understood that the HDR technique is more suitable for the architectural photographs mainly because its capability of capturing wide dynamic range.

However, when comparing interior and exterior HDR images that were taken in Dambulla and Polonnaruwa it can be apprehended that HDR technique is most suitable for the interior architectural photographs than the exterior architectural photographs. In Dambulla golden temple, there are five caves, which consist of vintage paintings and Buddha statues. However, it is very hard to take photographs inside the caves due to the lack of the light. In addition, artificial lights such as flashes cannot be used inside the caves due to the restrictions, which are formed to protect the ancient paintings.

Although HDR images of the Dambulla golden temple was captured under poor lighting conditions, it can be seen that the final photograph is very clear and shows all the structures in their natural colours and shapes. However, when observing the Ordinary photograph of the Dambulla Golden temple which was captured under the same condition it can be seen a dark and an unclear photograph. Therefore, it can be apprehended that HDR technique is most suitable for the interior capturing than exterior. When capturing exterior photographs there are so many light sources available such as daylight, moon light etc. Therefore, the camera settings can be controlled according to the lighting condition and there is nothing to worry as when capturing interior architectural photographs. Therefore, when considering about these factors it can be suggested that the HDR technique is a good technique for capturing interior architectural photographs.

Although this study was conducted to find out the competency of using HDR technique in architectural photography, when accomplishing the study it was diverted to a new pathway because of the unique feature of HDR technique to capture photographs of the objects

situated under low lighting conditions. In the archaeology field there are so many structures, paintings, statues etc., which are situated under low lighting, conditions and it is very hard to capture these subjects using the existing lighting conditions. Also artificial lights cannot be used when capturing ancient monuments due to the importance and protection of these archaeology monuments. Therefore, to capture the monuments situated inside caves and other low lighting places, the HDR technique can be used in order to obtain better results. Therefore, by conducting this study it can be proposed that the HDR technique is important to the archaeology photography as well as the architectural photography.

As mentioned above, this study was conducted in two methods. Other than the practical session, a questionnaire was prepared and distributed among the architectural photographers to obtain their view about using the HDR technique in architectural photographs. Also gathering information from the architectural photographers to identify whether they have a satisfactory awareness about the HDR technique was another purpose of the questionnaire. The questionnaire was sent only to the photographers through the web and collected and analyzed the data using the Google forms application. According to the gathered data from the questionnaire, it was found out that most of the photographers are not using HDR technique for the architectural photographs. However, the photographers who use HDR technique for the architectural photographs have given positive comments about using HDR technique in architectural photography. Therefore, from the results obtained through the questionnaire it can be apprehended that most of the photographers do not have any idea about the HDR technique and its outcomes.

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