**TOPIC APPROVAL PERFORMA**

Lovely School of Architecture and Design

**Program :** P772-NN1::M.Design (Interior & Furniture)

**COURSE CODE :** IFD623 **REGULAR/BACKLOG :** Regular **GROUP NUMBER :** ARCRGD0107

**Supervisor Name** : K.N.N. Singhara Kannappan **UID :** 21158 **Designation :** Assistant Professor

**Qualification :** _____ **Research Experience :** _____

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**SPECIALIZATION AREA** : Product & Industrial Design **Supervisor Signature:** _____

**PROPOSED TOPIC** : New tech in home interiors(Technology used in lighting and ventilation)

| Qualitative Assessment of Proposed Topic by PAC | | |
|---|---|---|
| **Sr.No.** | **Parameter** | **Rating (out of 10)** |
| 1 | Project Novelty: Potential of the project to create new knowledge | 8.00 |
| 2 | Project Feasibility: Project can be timely carried out in-house with low-cost and available resources in the University by the students. | 8.00 |
| 3 | Project Academic Inputs: Project topic is relevant and makes extensive use of academic inputs in UG program and serves as a culminating effort for core study area of the degree program. | 7.67 |
| 4 | Project Supervision: Project supervisor's is technically competent to guide students, resolve any issues, and impart necessary skills. | 7.33 |
| 5 | Social Applicability: Project work intends to solve a practical problem. | 8.00 |
| 6 | Future Scope: Project has potential to become basis of future research work, publication or patent. | 7.67 |

| PAC Committee Members | | |
|---|---|---|
| PAC Member 1 Name: Anuradha Kumari | UID: 20420 | Recommended (Y/N): Yes |
| PAC Member 2 Name: Raghuraman M | UID: 20626 | Recommended (Y/N): Yes |
| PAC Member 3 Name: K.N.N. Singhara Kannappan | UID: 21158 | Recommended (Y/N): Yes |

**Final Topic Approved by PAC:** **New tech in home interiors(Technology used in lighting and ventilation)**

**Overall Remarks:** Approved

**PAC CHAIRPERSON Name:** 1114::Atul Kumar Singla **Approval Date:** 27 Nov 2017

**Lovely Professional University**

# NEW TECH IN HOME INTERIORS

**Technology used in lighting and ventilation**

**A Dissertation**

**Presented to the Faculty of the Lovely School of Architecture & Design**

**Lovely Professional University**

**In Partial Fulfilment**

**Of the Requirements for the Degree of**

**Masters in Interior and Furniture Design**

**By**

**Kunal Sharma - 11609490**

**November, 2017**

# CERTIFICATE

This is to certify that **KUNAL SHARMA** bearing Registration Number **11609490** has completed his project titled, "**NEW TECH IN HOME INTERIORS**" under my guidance and supervision**.**

To the best of my knowledge, the present work is the result of the original investigation and study. No part of the project has ever been submitted for any other degree at any university.

This paper is fit for submission and the partial fulfilment of the conditions for the award of the degree of Masters of Interior and Furniture Design.

Signature and Name of the Research Supervisor

K.N.N. SINGHARA KANNAPPAN

Designation: Assistant Professor

School: Lovely School of Architecture & Design

Lovely professional University

Phagwara, Punjab

Date

# CANDIDATE'S DECLARATION

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation and referencing of published and unpublished sources). I, the student of Interior and Furniture of Design under Lovely School of Architecture and Design, Lovely Professional University, Punjab, hereby declare that all the information furnished in this paper is based on my own intensive research and is genuine with credits given for information collected from any other source.

Date: Name and signature of the student

# ACKOWLEDGEMENT

First of all, I would like to thank God for keeping me in good health throughout the project development and also I would like to thank my parents who motivated me and gave me strength which helped me to complete the dissertation.

I would like to express deep gratitude to my guide, Mr. K.N.N. Singhara Kannappan my mentor, for his guidance, encouragement and gracious support throughout the course of my work for his expertise in this field that motivated me to work in this area and for his faith in me at every stage of this research.

I would also wish to express my gratitude to the officials and other staff members of Lovely School of Architecture and Design who extracted their help during the period of my research work.

Then special thanks to Ravtej Singh, Student of Bachelor of Architecture at Gateway College of Architecture and Design who helped me by giving unique ideas. I would like to thank my classmates and friends, who have helped me with their valuable suggestions in various phases of the compilation of the project.

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# Abstract

*Lighting is the one of the most important part of our interior and our life. The influence of lighting situations on the performance and emotions of users, is capturing superior importance and becoming priority in our urban life. Although the literature on lighting is wide-ranging, it still lacks the dependency and major usefulness lighting on our daily life. Also, there is no technique which can be used by anyone in live scenario in their homes to count and get the recommendations of lighting fixtures and flux counts. Most of the research reported in this field uses subjective measures to study the sensitive effects of lighting on people and their moods.*

*Natural lighting depend on planning but it is just for daytime and clear days .If we talk about artificial lighting, it is needed for mostly all the time and a big part of any building which put significant effects on the users. Effects which can change the user's mood, emotion, performance and health. Most of the users never notice the poor or slightly poor lighting but their harms can be seen in daily life. Low productivity, eye strain, headache, irritation, these all are the negative effects of poor lighting, which are so common in these days. Many people are working online just at their homes, so performance will also be counted as negative impact. There is a solution proposed in the paper which can change the life of every user and their health. In this paper, we will find out how the technology of lighting in interiors will change the lives of millions of common people.*

# CHAPTER 1 - INTRODUCTION

Light is one of most used element and still rapidly growing every year as we are moving towards automatize controls. Year 2005, recorded the electricity through grid base intake for just lighting purpose was 2650 units (twh) globally. Division of electricity shows roughly 46% in office sector, 29% in residential zone, 15% in industrial sector and for streets, pathways and roads its 8%. Electricity use is more i.e. 80%, in developing countries as compared to developed countries i.e. 20%.So there is huge scope of this study in all those developing countries.

There are many researches done on efficient lights, energy saving ways and cost effective ways which can be used to save the electricity on lighting. Appliances can save energy as well and choosing the right technology of lighting can be useful too. Lighting intensity, brightness, number of appliances, quality of light, temperature of light etc. All these factors can only be covered or taken by only professionals or educated person who can know all these things while others will just do the lighting according to their mindset which will later invites all the problems caused by poor lighting.

## 1.1 RESEARCH QUESTIONS

- How Lighting is crucial for interiors?
- How lighting in interiors is categorized?
- What are problems of poor lighting?
- How technology can help in lighting industry?

- How that technology will reach to everyone?

## 1.2 AIM:

To study about lighting in interiors with respect to upcoming technology.

## 1.3 OBJECTIVE:

- Study of lighting in interiors and its effects on human.
- Study of latest technology and its uses.
- Merging the lighting and technology to make it more beneficial.
- Mobile application proposal

## 1.4 SCOPE AND PARAMETERS

There is information about merging the lighting and technology. Use it in in interiors or any type to get optimum lighting and a mobile application which tells us how to choose perfect and healthy lighting in your interior to increase the performance and health of users.

## 1.5 RATIONALE AND JUSTIFICTAION

The reason for choosing this topic is that there was many papers available in lighting but there is no paper which shows new lighting technologies. There is no technology which can be used by common people to calculate and live experience the lighting at

home. A new proposal is in this paper will make this research so useful and help choosing the right lighting for everyone for their home.

## 1.6 LIMITATIONS:

The research study is limited to lighting in only interiors of residential building.

## 1.7 METHODOLOGY:

### 1.7.1 Method(s) opted of Data/ case Selection and its Justification

Data selection is important for any research, which will help us to understand the topic better. There should be a qualitative data as well as quantitative data for statistics through which there will be enough information to understand something.

### 1.7.2 Method(s) opted for Data Collection and its Justification

1. LITERATURE STUDY
2. QUESTIONNAIRE
3. CASE STUDY(s)
4. VISUAL SURVEY
5. INFERENCES
6. PROPOSAL
7. CONCLUSION
8. FUTURE SCOPE

**LITERATURE STUDY**-

1. Information already exists is the limit

2. Not much literature available on A.R and V.R. as is a new technology.

**Limitations**

Available information may be incomplete as all the covered information was related to topic only.

1. Technology restrictions

2. Programming based

3. Time consuming

4. Expensive

**QUESTIONNAIRE**- Asking people a set of questions to understand more about the topic.

**VISUAL SURVEY**-

Visual survey is the observation of the surroundings through eyes. This method has been adopted to observe the existing situation of the built environment.

### 1.7.3 Method(s) opted for Data Analysis and its Justification

Data analysis is based on the literature study and the observation of built environment through the case study. This will help us to understand the architectural photography which gives us the qualitative aspect of the topic. Drawing a comparative analysis between various case as well as the literature and case studies is essential to analyze the collected data.

### 1.7.4 Advantages and Limitations of the method(s) adopted

The internet study mainly acted as a secondary source which helped to gather information regarding technologies. It generated the current information which will be very helpful for us. Whereas live research is considered to be the primary source of data which help to acknowledge the exact scenario. Such studies can help a person gain more experience as compared to the theoretical data collection.

**Advantages -**

1. To get the views of people, what they think about lighting and A.R. & V.R.?

2. Can improve to get additional information in person.

3. To find the need of this study and proposed solution.

**CASE STUDY- 1.**

Application Studied - A.R. Explorer Kit

New tech in Home interiors

Platform - iOS

Year Launched - 2017

Developer – Plain Code

The case study of this application is done because of the optimization and device uniqueness. This app worked best from 20+ applications tested during dissertation. The app uses 3D grid system to find the planes or surfaces. This tracking technique uses the camera and augmented reality program. Technology which is used in this app is relevant with my topic and used to study for proposal app development.

**CASE STUDY- 2.**

App Studied - Augment

Platform - Android

Year Launched - 2017

Developer – Augment inc.

The case study of this application is done because it works with Android OS and the global market share of android is approximately 80% .It uses camera's view angles and detect the surface. During the course of testing the application didn't work as smoothly as iOS application but it still works and fully functional and future updates might improve the performance as well as stability. Technology which is used in this app is relevant with my topic and used to study for proposal app development.

# CHAPTER 2 - LITERATURE STUDY

## 2.1 THEORY OF LIGHTING

The broad field of this study is lighting design with respect to interiors. The ultimate goal of research in the widespread design field is always the improvement of it for the consequent enhancement of human life. In the case of lighting design in interiors, a narrower specialist area, there has long been established a need for it. People don't know how much they need to improve in this sector. There in specialist which design the lighting according to need. People just put the lighting according to electricians. *"Design that clarifies and informs architecture and cityscapes is not just satisfactory and comfortable light as achieved by illuminating engineers."* (Skaarlatou, 2010)

### 2.1.1 The lighting design

However, lighting design is not a relaxed subject for several reasons, which are explained below. There are many difficulties to make the correct light. Problem is that light need to be specified for area which will change accordingly. For bedroom we need different lighting, for kitchen it's different so the lighting design is a tough call. Without good lighting we cannot achieve the best level comfort as it will always let you feel uncomfortable silently. The other struggle of research is technology, which changes very frequently. After every research, technology changes, new appliances with new techniques come and it has its own benefits and flaws.so, this never ending topic. (.Speirs, 2005)

Firstly, light is a subjective thing and the subjectivity of it is the leading philosophical problem in this study that recurs annoyingly throughout the course of its unfolding. (Birren, 1999)

Secondly, apart from being subjective, light is also *non-material,* but with the inconsistency of having a very solid presence or absence for everyone, while few people will notice and comment on average levels of light or distinguish between poor and decent quality of light, most people will notice the presence of a very strong light or intense darkness or light conditions close to the two limits and will practice very intense emotions about these phenomena. Light can be accurately measured, but no amount of measurements can transmit the core of a light phenomenon and therefore capture its presence, as this is captured in the human perception and uneasiness. *"In the light research field this inconsistency causes methodological conflicts, in their nature, which are mostly recorded as a shift from quantitative to qualitative methods, numerical to perceptual, or the engineers' word against the word of designers and artists. (Abbas, 2006)"*

Finally, lighting presents another problem i.e. Light is practical not theoretical. A phenomenon related to light cannot be fully reproduced, described or explained, no matter how accurately recorded and conveyed, and this gives people who have visually experienced a light phenomenon an clear advantage over those who have not.

## 2.2 DEFINITION OF LIGHT EFFECTS

There is often in texts a reference to ‘light effects’ and yet no formal definition of this concept has seen in any of the lighting literature. One might question how a light effect is identified and defined and if categorized, according to what ideologies this categorization takes place. Moreover, what is the usefulness that validates the determination here of trying to classify the light effects into types?

To define a concept is to grasp its intangible identity and to be able to explain with words something that is commonly understood and professed. Light effects are commonly understood and admitted as notions by lighting designers. (Abbas, 2006)

Talking about effects Cove lighting is a name that originates from the procedure of hiding a linear source inside a cove detail and restricting its ‘flow’ to the limits of the cove opening. This, however, does not answer the query of how light effects are identified and defined. Answering this will lead to answering the second question of classification and its role in design. This set of questions will not expand much on the typology and the ‘idea of type’ because this can be a research subject on its own, but will emphasis on the question of lighting effects as ideas and the criteria of differentiation. If one can see clearly enough the difference between two light effects then this will enlighten their de-composition into types and their re-composition into full lighting schemes

### 2.2.1 Theory of natural lighting

Natural lighting is very important for any interior space. In home interiors, it is always an efficient, healthy and sustainable idea to make most of natural light used in interior. But the effects are positive and negative too. If we have any material which reflect the light, it can make uneasy to see or harsh glare will end up disturbing the user. Quantity of natural light is major factor which can put a huge effect on artificial light. There is no need to use artificial lighting appliances during daytime if natural light is working well for you. Light colors also put effect on human mind. Daytime, the color of sunlight defaults to yellowish or orangish i.e. warm colors. (Skaarlatou, 2010)

### 2.2.2 Theory of artificial lighting

Artificial light is very essential in our daily life as natural light can only works in daytime but artificial lighting can be used both times i.e. daytime and nighttime. In any interior work design, artificial light puts effect on whole scene which can make a view looks outstanding or worst. (Birren, 1999)

In any interior lighting, color temperature and chromatic rendering index are the main elements which makes the color quality which put effect on user's mind. Colors can make you feel warm in cold area and make you feel cool in hot weather. Color plays with mind of user make your mind more creative, refresh, open, and free. All these factor put major effect on the productivity of human brain and body. (Negrã, 2013)

## 2.3 THE BROAD FIELD OF THE STUDY

### 2.3.1 Intangible nature of light –

The intangible nature of light effects might not be that mysterious after all. It has been demonstrated that during the design process they are understood as lighting tools that are shaping space, organizing space and reproducing generic space and light qualities previously experienced and recorded in the users' memories as positive. Those conclusions clarify and replace the unclear quantity of informal descriptions of light effects used in lighting designers' practices with descriptions which are richer in content and more useful in the preparation of lighting schemes. The direction and aiming of the source, the geometry of light distribution and the illumination perspective are more helpful to the thinking that takes place during the design process because they already contain the space element in them. It does not have to be invented, so when designers face a certain space configuration in the design process they know, for example, that certain light distributions are suitable to serve the forms given by the architects, while others are not. (Abbas, 2006) When facing a sequence of spaces with strong perspective and their concept is to reinforce this, they also know that illumination perspective is a design principle that can help them achieve it. Likewise with the organizational effects, designers can organize the lightscapes by deciding on the active or passive role the light sources will have in a scheme, or by deciding the surfaces that they want to be dominant against the secondary or tertiary ones. (Brandston, 2008)

### 2.3.2 Effects can be learnt by perspective views

But in order to acknowledge the usefulness of light effects in the design process as suggested in this study, some conditions need to exist. Firstly, the anthropocentric view of lighting spaces needs to be a core value of the designer because this will mean that the effects planned are seen from the human visual system point of view and will be applied to architectural spaces with the same objectives. Secondly, the appreciation of content in lighting schemes apart from the aim of formal perfectionism has to be chased. Future research should focus on people's appreciation of content in lighting schemes by studying all the historical and contemporary visual influences

### 2.3.3 Position and aiming of the light source

The position of light matters as our needs. Light will decrease its intensity as far it will travel. Lighting position will be directly connected with the end result so the position of appliance can make an interior space comfortable or uneasy to stay in. Task lighting is one of the biggest examples of it as it need proper light on the task area. If we want the horizontal surface to get the proper light, the position of the appliance will matters a lot. The light will only then, gives the final result we wanted if position is good. Other example can be ceiling light with fan interference.in India, there are many homes where the light has some weird results. If light is reaching oh the area and light has to get through the fan, it will create the negative result as fan will create moving shadow on the particular area. That will affect the convenience of the user like if someone is writing on paper, that effect will distract the user so much that it will feel so inconvenient.

Aiming of light is more dynamic as it counts the angles. This more crucial in display areas where spot lights will make the retail display being functional. Exhibition is biggest example of this as we need proper hidden light which is totally depending on the aim of light. The aim will be, in exhibition case some painting or wall hung product which looks bad if light misses the aim so aim becomes crucial in those cases where the focus lights are used. (Brandston, 2008)

### 2.3.4 Designing a more meaningful space

Having established the type of building, its size and organizational structure, the initial ideas for the design of the house were considered in relation to three main goals: to challenge the convention of ceiling and floor, to include various geometries in the architectural envelope, and to provide long views in the form of sequences of spaces in the vertical and in the horizontal, encouraging designers to address the issues of direction/position, geometry and illumination perspective while proposing light effects for the spaces.It was explained why this perception of light effects has completely stripped out the space parameter and a fact that every lighting designer knows by experience: that the distance and position between the sources and the surface are key factors for the visual result of light effects and have quite as much effect as the technical characteristics of the fixtures. Consequently a more unexpectedly proportioned space, let us say a room 5m high, would raise problems of positioning the light fittings and after solving this, the problem of aiming their beams would arise. (Negrã, 2013)

The direction and position of the light source are basically a designer’s answer to his/her own question (provided that he already knows the effect, he is about to plan):

where should the light be mounted and where should it aim? This thinking goes even further by asking oneself, what if there is space below the floor and so the floor-to-ceiling height is also extended beyond the average 2.8m? Should the light be positioned there? Is it appropriate? And if mounted there, should it aim upwards as is the most obvious answer? What are the consequences of that? Those problems mainly exist because the efficiency of light fittings is manufactured for the range of 1.5m to 3m with the exception of floodlights, which are designed to be more powerful to cover longer, mostly external, distances. But it is not just the tools' inefficiency that causes problems for the designer. (Birren, 1999) It is also the space that allows the user to move inside it via unexpected routes and having various views that the designer has to predict and provide visual comfort or visual interest for. More accurately, he has to provide for anywhere users might turn their heads and how glary or dark that area of space will look. Therefore the space and the possible moves of the users inside it are the primary factors that direct the position and aiming of the light fitting. A space that has different floor levels will provoke interesting reactions from the lighting designers, as it will stretch their inventiveness, and should provide interesting outcomes.

### 2.3.5 3D is best visualization

Now linking those with the responses of the designers, it turns out that even though the expressed concerns of each designer were different, the way they processed the space in order to decide on a lighting scheme involved a way of thinking that cannot be ignored. Most of them imagined the space as it was depicted in the drawings and 3D model and placed themselves in the position of the user, trying to guess the areas he/she will focus

on when first entering the building either as an owner or as a visitor. (Birren, 1999) Then based on that thinking they decided on the possible areas they would ‘like to light’ involving this reduction and elemental brightness/contrast function. This means that they perceived the lighting design scheme from the human visual system (anthropocentric) point of view as a core strategy, and then developed their decisions with technical knowledge (type of sources and power, beam distribution, color temperatures, precaution against glare etc.) Some designers, envisaging the space as if walking through it, tended to describe it as if they were talking to someone or to themselves. On the other side, there are designers who ‘processed’ the space in plans while mentioning that their primary concern was to reveal the architecture, but who applied effects (such as down lighting) which annulled their initial intentions but were a sure way of achieving desirable light levels on the horizontal. This reveals the division that is often met with in an individual lighting strategy and which indicates a confusion of values. Not all designers contradicted themselves in an overt way. However, discussing the level of contradiction with regards to other designer characteristics in order to establish causality is again beyond of the scope of this study. This underlying division nevertheless affects the way light effects are understood and employed in lighting schemes. (Skaarlatou, 2010)

## 2.4 TWO WAYS TO UNDERSTAND LIGHTING DESIGN

Lighting designers have divided the light and this is reflected in both the naming and use of light effects. They are not divided into two groups supporting the qualitative approach or the quantitative approach. They are divided as personalities trying to

compromise between two different ways of looking at things which cannot in fact be compromised because they differ substantially. Some are inclined more to one side than the other, but all present the same reluctance to denounce the one as that would be considered arbitrary and unprofessional and conversely they are reluctant to totally denounce the other because they could not then justify their designer's creative role in the process. On one side stands the engineer-based approach to lighting which revolves around the light produced from the source, and on the other is the human-based approach to design which revolves around the average individual and his/her body position and consequent eye level. The first could be called photocentric lighting and the second could be called anthropocentric lighting. (Abbas, 2006)

### 2.4.1 Anthropocentric lighting

*Fig. 1 Exhibition hall showing vertical surface lighting*

*Source - (Abbas, 2006)*

Anthropocentric lighting thinking is an arbitrary term used here to signify design thinking that places man in the center. Light is designed around him and he is the point of reference. His visual system and processing methods are envisaged by the designer. The designer places him/herself in the user's eyes and imagines lit space as walked through by the user. The position of the sources is referred to as low level, when this is lower than the level of user's eyes, and high level when higher than the user's eyes. The abstract thinking that takes place is done in the best interests of the user. The designer assumes the vistas and points of interest that the potential user will focus on and reveals them correspondingly. The architectural space is lit for the user to enjoy its limits when focusing on the background, and the objects inside it are for the user to inspect and appreciate when focusing on the foreground. The lit architecture evokes a relationship of background and foreground in the anthropocentric system, as the point of interest is not the envelope but its sense of enclosure when talking about interior lighting. At base, anthropocentric lighting relates to the philosophy of visual studies. Visual studies examine the way people see and perceive the visual environment whether one accepts or not that those processes are in fact simultaneous and interdependent. For visual studies the subject is the human visual system; therefore the object of study is the visual environment as perceived by an individual. Lighting engineering however considers two subjects: the light sources and the human perceptual system with the object being the incident surfaces. With two subjects in mind, attention shifts from the one to the other with no clear criteria for this shift. (Abbas, 2006)

### 2.4.2 Photocentric lighting

So one could say that in this type of thinking there are three participating elements. It could be easily named photocentric3 lighting if it is recognized that the primary attention is given to light sources, as they are considered the primary causes of light effects. There is a certain causality in engineering lighting: an effect that begins with the emission of light while everything else is considered a consequence of that. By contrast, anthropocentric lighting is not causal but it is highly subjective as its sets its system of observation clearly: the user's eyes and brain centers. Defining it this way automatically allows that another system of observation is possible. Recognizing the problem that occurs when one considers both the absolute light quantity and the subjective human perception of light, lighting engineering has devised two physical measures for the same phenomenon: luminance and iluminance. The first remains invariable for the human perceptual system (a surface is perceived as bright independently of the distance of the viewer) while the second remains variable for the human perceptual system but is invariable for the source itself. The surface will continue emitting the same quantity of light irrespective of where the viewer stands or how the colors around him have changed. This double reference system has caused, if not conflicts, at least disagreements about what lighting design should be based on. There are designers who advocate the use of luminance instead of illuminance while estimating the overall result of light in a space, while others find it more practical to use illuminance since lighting designers have little control over the final finishes, textures and colors of the project. Most of the time the clients do not even think it is part of their job to allow lighting

designers to influence those choices and leave this instead to the interior designers, for large projects, or to the architect, for smaller ones. (Abbas, 2006)

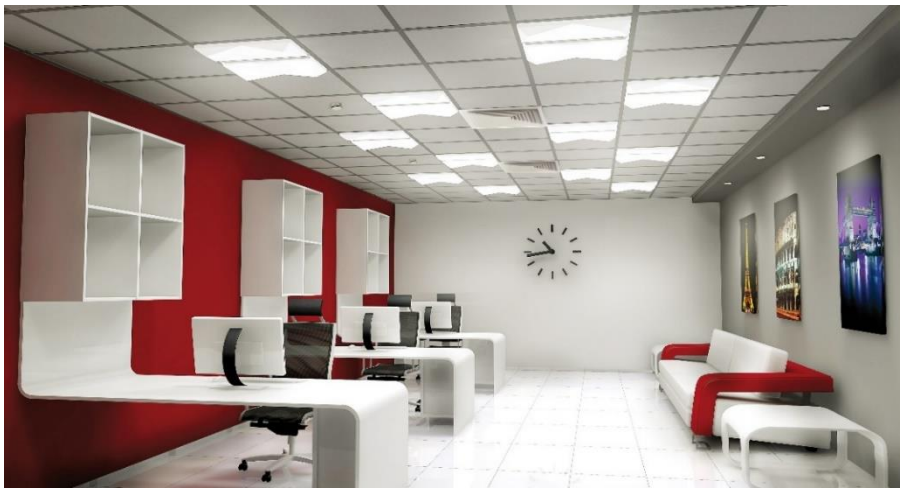


*Fig. 2 Explanation of horizontal surfaces lighting*

*Source - (Billinghurst, 2012)*

### 2.4.3 Comparisons of both ways

*Table – 1 Difference between Photocentric and anthropocentric*

| Photocentric | Anthropocentric |
|---|---|
| Lighting marking in plans | Lighting marking in elevations, renders and 3Ds |
| Checking illuminances (E) on horizontal surfaces | Checking luminances (L) of vertical surfaces |
| Lighting strategy according to the task performed | Lighting strategy according to the space character |

The division between anthropocentric and photocentric lighting strategies also offers an explanation for the use of metaphors and archetypes. The anthropocentric system considers firstly the human visual system and the collection of resulting experiences,

and secondly the technical way to produce effects that enhance them. Terms which include metaphors or experienced images, such as ‘paper lantern’, or ‘candle light’ or ‘ambient light’, or ‘gloomy’ or ‘halo light’, belong clearly to the second group of light effects. Those terms when communicated provide a lucid image of the final appearance of an effect without any need for technical clarifications, because they are ‘humane’ in their very nature. They are icons created by human experience to be recreated for human appreciation without the necessity of a technical language to designate them. (Abbas, 2006)

One possible explanation for these conflicting trends within individual designers’ minds is the acknowledgement that the designer’s knowledge consists of his/her education, acquired experiences and personal preferences and of current trends. The fact that the intellectual tradition of lighting is based on engineering approaches, while theories of the design of light have been totally absent from most students’ official curricula has left designers with no theoretical ground on which they could solidly argue against the numerical guidelines. However, it has to be said here that unofficial knowledge, transmitted verbally within practices, is present in designers’ thinking in a loose sense that they cannot articulate but that can nevertheless be traced by the reader in the transcripts, and after reading the literature review. A quote from John’s interview provides a very good example of this. At some point in his scheme John introduces a ‘technique’ of mixing warm tones with cool tones (allowing them to bleed through) when lighting a three-dimensional object, in this case the helix-shaped staircase standing in the middle of the workspace. When asked, John described this technique as

originating from the theatre an as being successful when the designer wants to produce three-dimensionality (to give depth) for an object (actor). (Bealieu, 2001)

# CHAPTER 3 - TECHNOLOGY

## 3.1 AUGMENTED REALITY

### 3.1.1 Definition

Augmented reality is merging the real world element to virtual world. It uses mobile camera to take the view of real world and some application with virtual elements which can be merged with the real world by finding surfaces. Sense in the app which use camera and gyro sensor of phones to measure depth, surface and axis. Then the virtual elements can be used in all real world images or live views which is majorly used for entertainment purpose like moving digital giant alligator with your pal in the playground of your school. This technology became famous after a game called Pokémon Go came to iOS and android platform. It merges the real world walking scenes with virtual Pokémon elements. user need to open the game which triggers the camera and then we go to different locations and find digital pokemons.The app required the internet as it was location based app but it was so great that it was downloaded in millions and it was trending all over the globe. For further information about that game, case study is there in this paper for in depth technology it used and how it was a global success. (Brownlee, 2017)

Augmented reality was used or we can say tried to use many times. Its uses are in many ways. Mainly this technology is being used in vfx and movie animations. All the Hollywood animation is done from years by augmented reality which needs sensors which map the face of human being and its expressions and digital animated character will do the same on screen. Avatar is a relevant example of facial mapping A.R. which

is biggest grosser of all time Hollywood movies. Avatar used this technique on very large scale and results out as big success. In educational sector many A.R. apps provide learning digitally which makes the subjects easy to learn as well as interesting for kids as it needs interaction of the user. (Fisher, 2016)

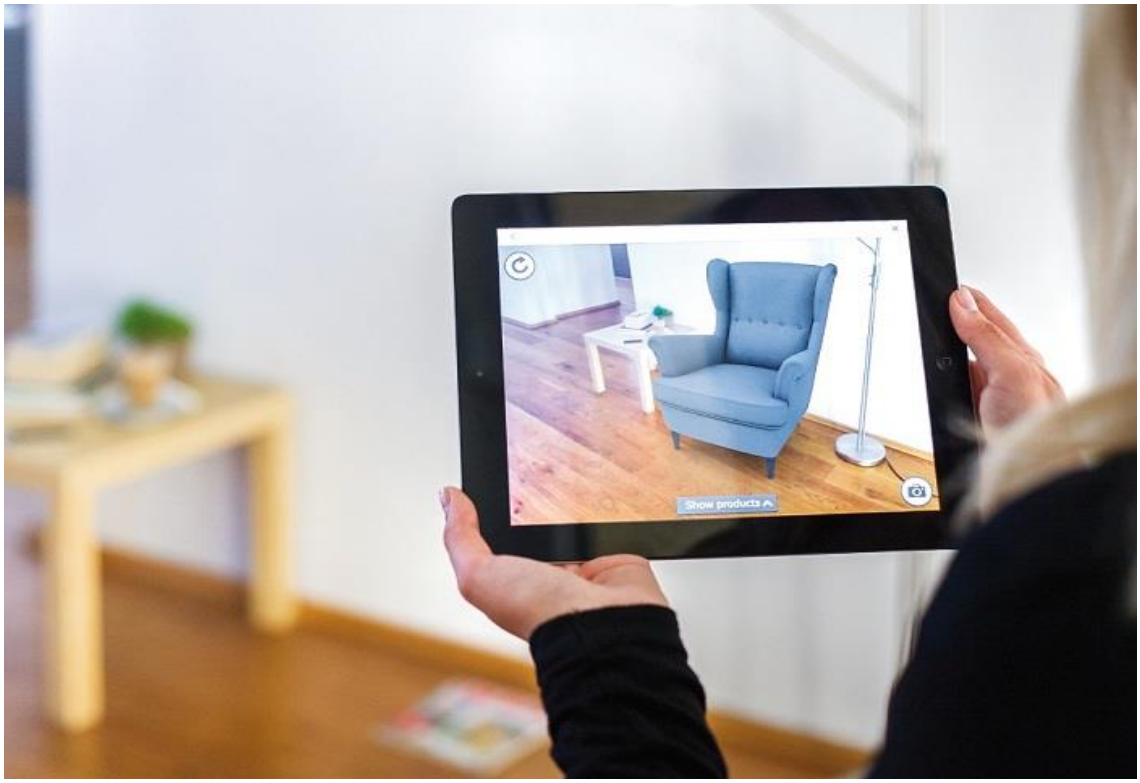



*Fig.3 Using A.R. for furniture visualization*

*Source - (Brownlee, 2017)*

### 3.1.2 Mobile augmented reality

Augmented reality also known as A.R. came in existence in 1960s but it never approached to any average user by 2000s as the technology needs camera to work. 1970s was the period of cellphone as Dr. Martin Cooper introduced first mobile phone under Motorola but even after 30 years from first mobile phone, camera was never

introduced in a cellphone until 2002, when Nokia released first mobile camera in Nokia 7650 model which had 176x208 vga resolution camera. It started a homerun for mobile cameras in which Blackberry, L.G., Motorola, Samsung and in 2007, Apple joined with its first touch screen cellphone called the iPhone. Recently, two main operating system android and iOS has camera requirement to run their platform so all the mobile phones have mobile cameras with minimum 5 megapixel camera to 45 megapixel cameras which can easily run augmented reality apps. Now we are in the world of apps where we can install any app by the touch of a finger. App developers can make any app which can run to their respected platform. (Billinghurst, 2012)

### 3.1.3 Challenges

In every technology, there are challenges to make it work right which includes software issues, hardware limitations and human errors. Software issue carries a big challenge i.e. smooth integration of natural elements and virtual objects. For example, if we want to put a virtual chair in a room, software need to detect surface through camera and merge the shadow on that surface material which is a big challenge to deal with, Hardware limitation basically suffers with camera lighting as scene get dark, camera can be more prone to pixilation and A.R. will start becoming hit and miss. Other than lighting, camera quality also suffers scene by scene and Lack of HDR and optical image stabilization can be a problem for some devices. All camera sensors in all the mobile phones differs the output which can put a significant effect on the results. Human errors also put a major effect on the output as many people have shaky hands which can blur

the view and many users might not have the sense of photography which led to unrealistic picture outputs. (Billinghurst, 2012)

## 3.2 VIRTUAL REALITY

### 3.2.1 Definition and background

Virtual reality, also known as V.R. is projecting of real time environment in digital realistic scenes by use of gyroscope and motion sensors of device. It was first introduced in 1950s but was limited as technology in that time was limited. Fig.4 shows V.R. consoles with high charges hourly, in 1960s. In early phase i.e. 1990s , it was limited to computers as it needed large amount of power as well as big screen with high definition graphics.it uses 3 sensory of human bodies like touch through game pad , eyes by display and hearing by headphones or speakers of device.


*Fig. 4 Virtual reality console in 1960s*

*Source - (Billinghurst, 2012)*

### 3.2.2 Working

Virtual reality makes digital environment and the user feels like walking live in it. Hand remote controller is the key element with controls in it. Everything in that world is non real and digital which feels realistic with animations. It uses application, Internet, graphics, animations and V.R. headset to make a digital environment. (Changkyoung, 2015)

*Fig.5 Virtual reality headset in 2017*

*Source - (Saf, 2017)*

### 3.2.3 Challenges

Virtual reality needs to have good quality of screen on device. Device should have quad H.D. or amoled display to work it right. Also the display needs to have dense pixel density at least more than 400 P.P.I. to make the V.R. experience worthy. (Brownlee, 2017) Oher than display, the V.R. headset should be of good quality.V.R. Lens is the main reason of making the experience realistic. Vision and hearing are only get excited

by quality of headset. Many low quality V.R.Lenses just made the reality un-real so the quality of lenses and sound system of headset should be to notch. (Brownlee, 2017)

## 3.3 Virtual reality vs. augmented reality

Virtual reality, also known as V.R. is projecting of real time environment in digital realistic scenes by use of gyroscope and motion sensors of device while augmented reality is merging the real world element to virtual world. It uses mobile camera to take the view of real world and some application with virtual elements which can be merged with the real world by finding surfaces. (Changkyoung, 2015) Some major differences can be seen in *Fig.6.*

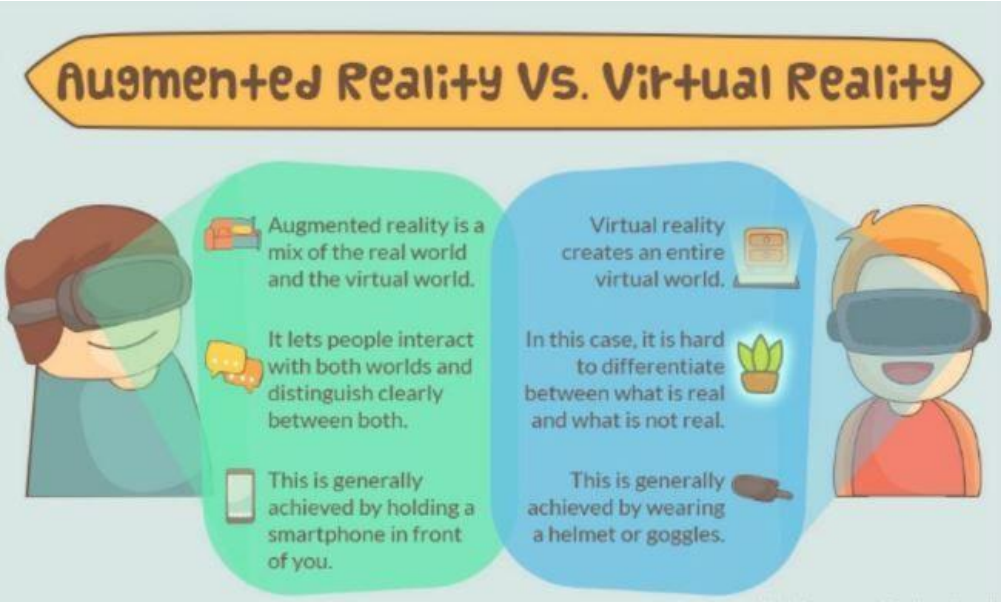



*Fig.6 Augmented reality versus virtual reality*

*Source - (Billinghurst, 2012)*

## 3.4 PHOTOGRAPHY -

Photo and graphic were derived from Greek word i.e. ‘fos’ (the scene) and ‘graphien’ (to draw) so drawing a scene is called Photography. The word photography was used in 1839 by Sir John F.W. Herschel. It was like a painting of exact subject but it is much more than just a painting.it is capturing the very moment with exact subject and scene. It was meant to be raw but nowadays some tools and rendering of image works to make the scene even better than real life. (Billinghurst, 2012)

### 3.4.1 Tool-

To document, shown, displayed and even to spread one view around the world, photography is a great tool for architecture as well as interior designing. Sometimes it might be better than the real building. Because of the aging of building, it might get damaged or loose its finish but its digital view might live longer than actual building. Even there is scope of manipulation to improve the building’s beauty even better or under some critical cases, for example- If we go to shoot Taj Mahal and after reaching there we get to know that it is under construction so we will click photographs in different and unique angles to manipulate so that the person viewing the photograph will not be able to judge the position of the photographer and certainly might not get idea as it was building or under maintenance. Using proper camera techniques can hardly produce striking architectural photographs especially because of subject which is a structure that already exists. There are some techniques to capture as we should take care of lighting, proportions, balance, contrast, shadows, reflection etc. Also, nowadays

new generation has taken photography as a hobby. In documentation of architecture and interior design, photography is necessary and it becomes very helpful.

### 3.4.2 Relevancy in research -

Interior designing and use of technology with photography can be define as the process of study and research on understanding the integration of built environment with the help of photography i.e. Augmented reality. Live display and real time scanning can be achieved by the camera of device either mobile phone or tablet or pc. We need to learn very basics of photography for proportional view of interior to get proper lighting which is easy to get as everyone can have little sense of photography.

### 3.4.3 Point of view

Point of view is also a crucial point to take care of. To show the client, 3d images of interior design is always a good idea just because in 2d or imagination his/her point of view might be different but if we show them a digital picture, they will change their view. In other sense, photography also needs a point of view i.e. the angle of picture taking while putting all those augmented and virtual reality in it. This view should be from the angle where user can judge all the lighting devices and their proper effect.

# CHAPTER 4 - QUESTAIONNAIRE & ANALYSIS

## 4.1 QUESTIONNAIRE –

1. Do you feel headache, eye strain and stress at your workplace at home?

   ☐ Yes ☐ No

2. Is there any problem in your existing lighting?

   ☐ Yes ☐ No ☐ Never Noticed

3. Do you know how much light do you need in your bedroom or workplace or any interior area?

   ☐ Yes ☐ No

4. Have you designed your lighting from light engineer / specialist?

   ☐ Yes ☐ No

5. Do you know the type of your lighting i.e. Fluorescent or L.E.D.?

   ☐ Yes ☐ No

6. Which light color do you like and feel comfortable in?

   ☐ Warm ☐ Cool

7. Do you want your interior lighting to be calculated for specific area?

   ☐ Yes ☐ No

8. Do you want to see or experience the actual appliance and light effect before putting the appliance?

   ☐ Yes ☐ No

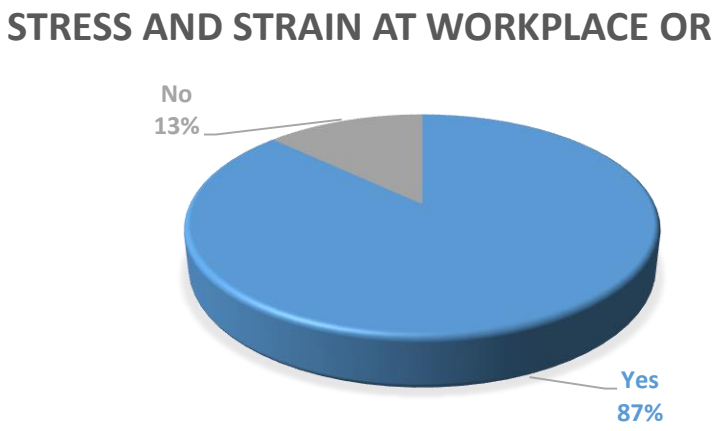
9. Do you want to have suggestions and appliance recommendations of professionals on fingertips?

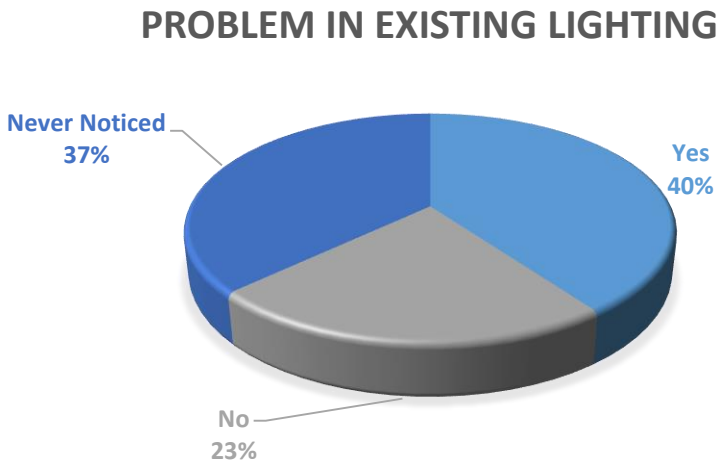
   ☐ Yes ☐ No

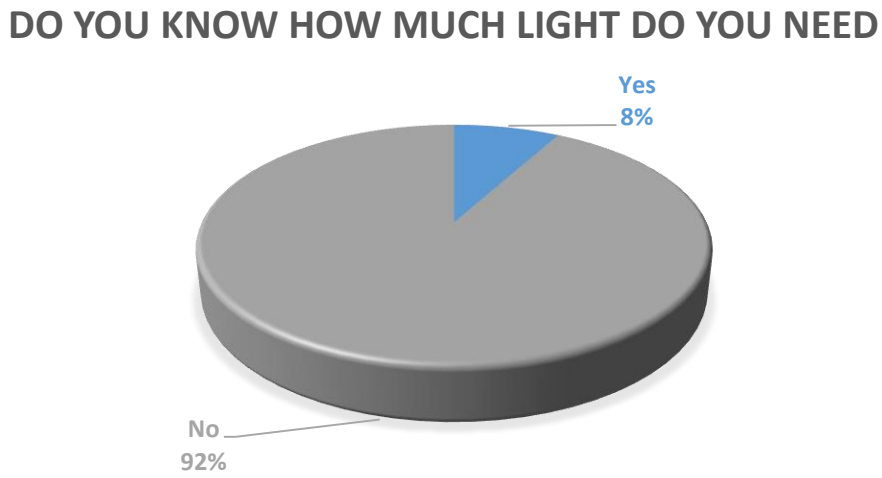
### 4.1.1 Questionnaire Analysis –

Sources –

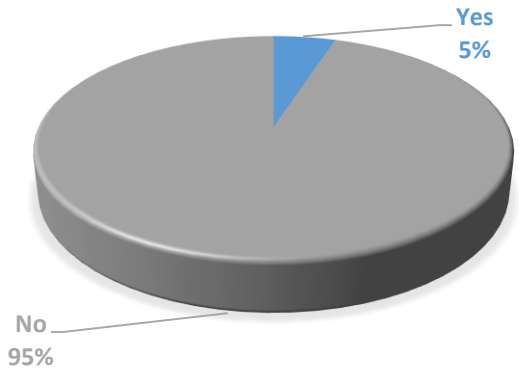
Google forms, Questionnaire filling, live questioning and Instagram polls.


STRESS AND STRAIN AT WORKPLACE OR HOME
No
13%
Yes
87%

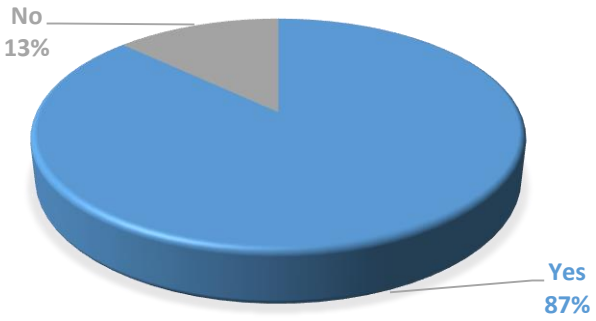

PROBLEM IN EXISTING LIGHTING
Never Noticed
37%
Yes
40%
No
23%


DO YOU KNOW HOW MUCH LIGHT DO YOU NEED
Yes
8%
No
92%

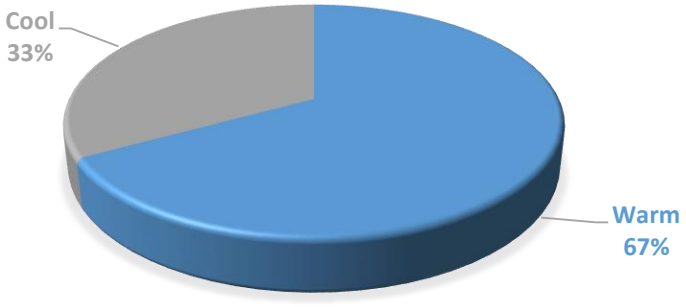
## HAVE YOU DESIGNED YOUR LIGHTING FROM SPECIALIST

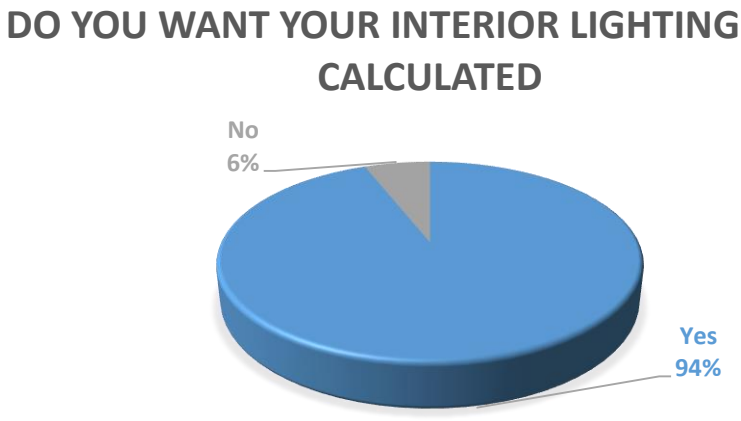


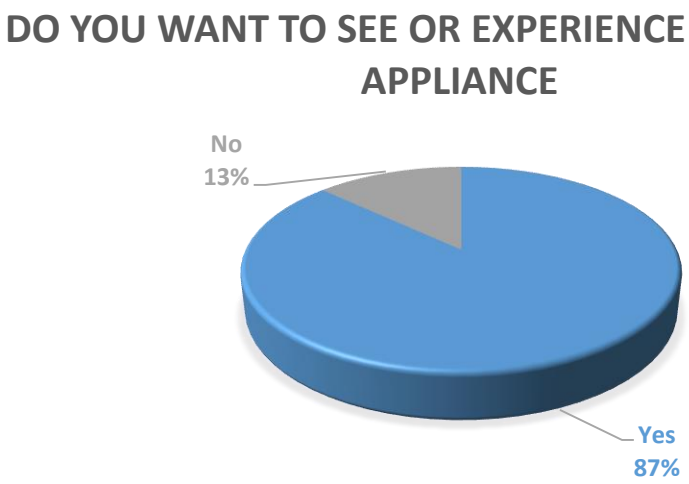

## DO YOU KNOW THE TYPE OF YOUR LIGHTING

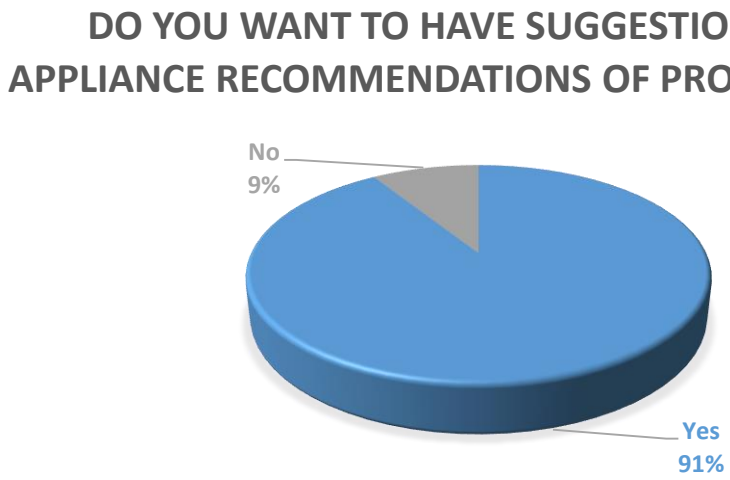



## WHICH LIGHT COLOR DO YOU LIKE AND FEEL COMFORTABLE IN




DO YOU WANT YOUR INTERIOR LIGHTING TO BE CALCULATED
No
6%
Yes
94%


DO YOU WANT TO SEE OR EXPERIENCE THE ACTUAL APPLIANCE
No
13%
Yes
87%


DO YOU WANT TO HAVE SUGGESTIONS AND APPLIANCE RECOMMENDATIONS OF PROFESSIONALS
No
9%
Yes
91%

# CHAPTER 5 - CASE STUDIES AND ANALYSIS

There is no large scale application used till now but still some existing applications done pretty good job for teaching us how this technology i.e. augmented reality, works on mobile devices. Applications just used the camera of mobile devices and showed dimensions, markings, surfaces and shadows which is a big victory. These apps are object based i.e. Furniture, pots, cups etc. and other ones are fun based like animals. 2 case studies are done that shows basic A.R. exploration on iOS and Android.

## 5.1 LIVE CASE STUDY 1

### 5.1.1 A.R. Explorer Kit

5.1.1.1 About the Case Study

Platform - iOS

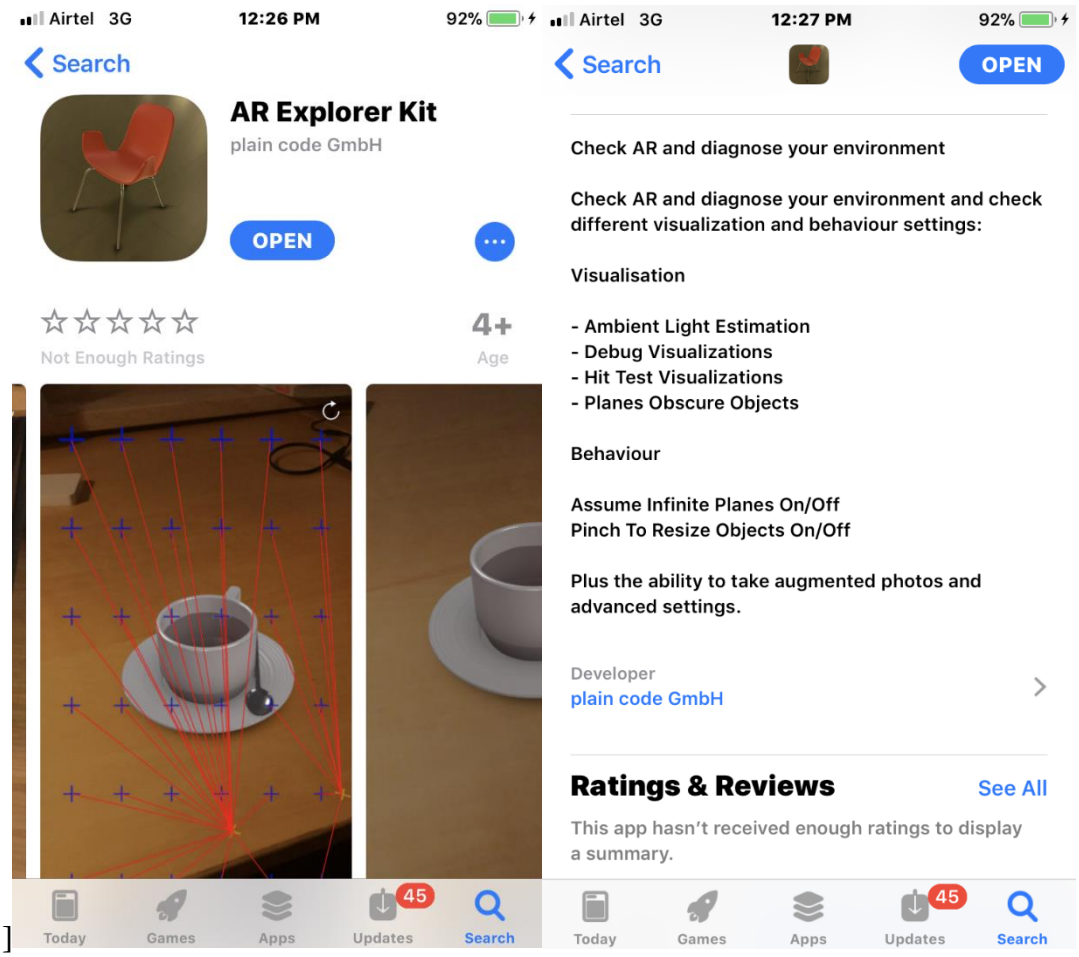
Year Launched - 2017

Developer – Plain Code

Device used – Apple iPhone 6s (64Bit Architecture)

Internet Required – No

Models available – 5 Build in models are available.




]

*Fig.7 Screenshot of mobile application on Apple Appstore*

*Source – iTunes Appstore*

### 5.1.2 Process followed

The app uses 3D grid system to find the planes or surfaces. This tracking technique uses the camera and augmented technology which place the dynamic object virtually in the camera scene with real time moving and zooming functions. Pinch to resize the object, dimensions counting, grid making are the additional features of this application. Process followed for the application can be seen in Fig.8

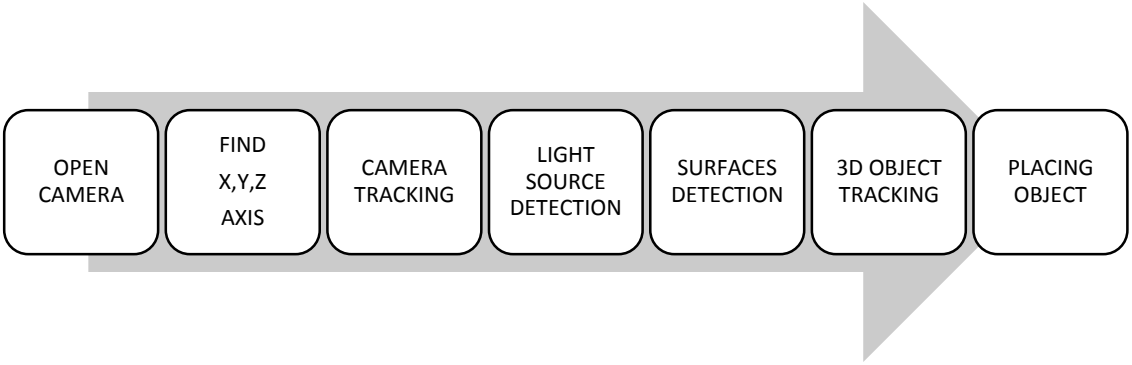



*Fig.8 Flow diagram of process followed*

5.1.2.1 Finding Coordinates

First, the invisible dots will trace the surface coordinates. The surface finding can be little tricky as this needs proper view of camera for app to find the proper X, Y, Z Coordinates. It creates digital coordinates which makes it easy to make a virtual surface track. *Fig.9* shows the default scenes taken for a demo of app.

*Fig.9 Sample scenes taken for experiment*

5.1.2.2 Surface Tacking and Grid Making

Then it finds a surface to put object on. Surface indicated by a yellow virtual square which shows real time surface scanning. The message bar also shows ‘Surface is detected’ on success.in following picture we can see that yellow square which reflects the surface selected as shown in *Fig.10.*

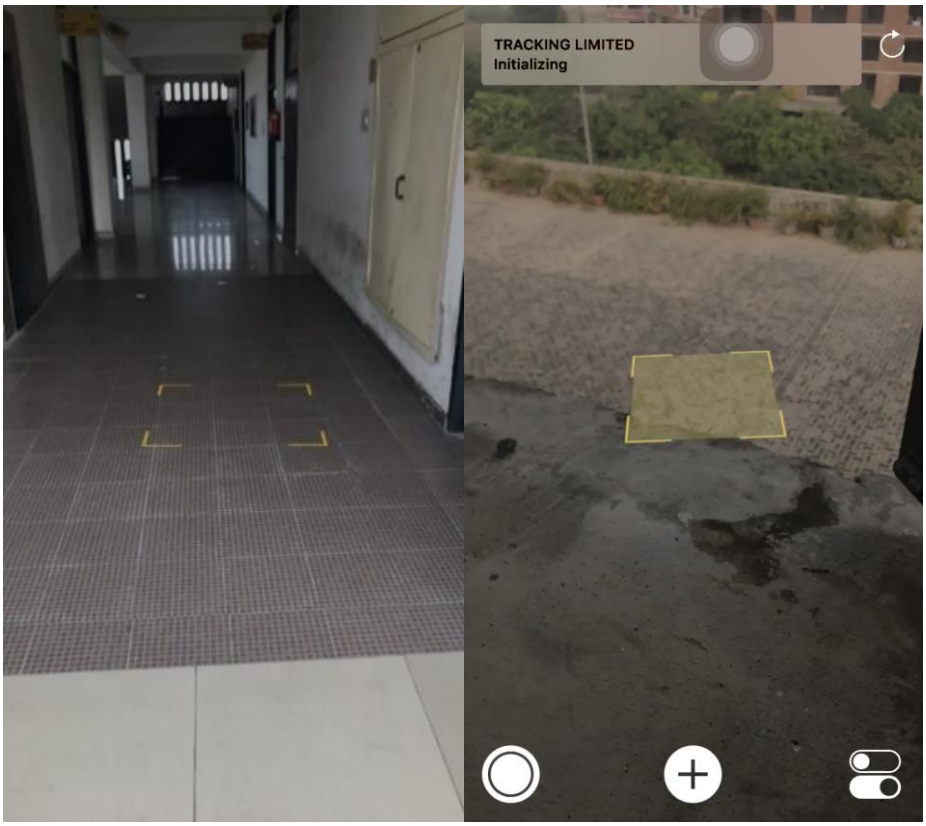



*Fig.10 Mobile application finding surfaces*

Surface Detecting and Object Placing

Then the shadow part is counted by the grids. Then we got the option of ‘ADD OBJECT’ and we can easily place the object on it as *Fig.11* has a Virtual Chair on that earlier selected surface.

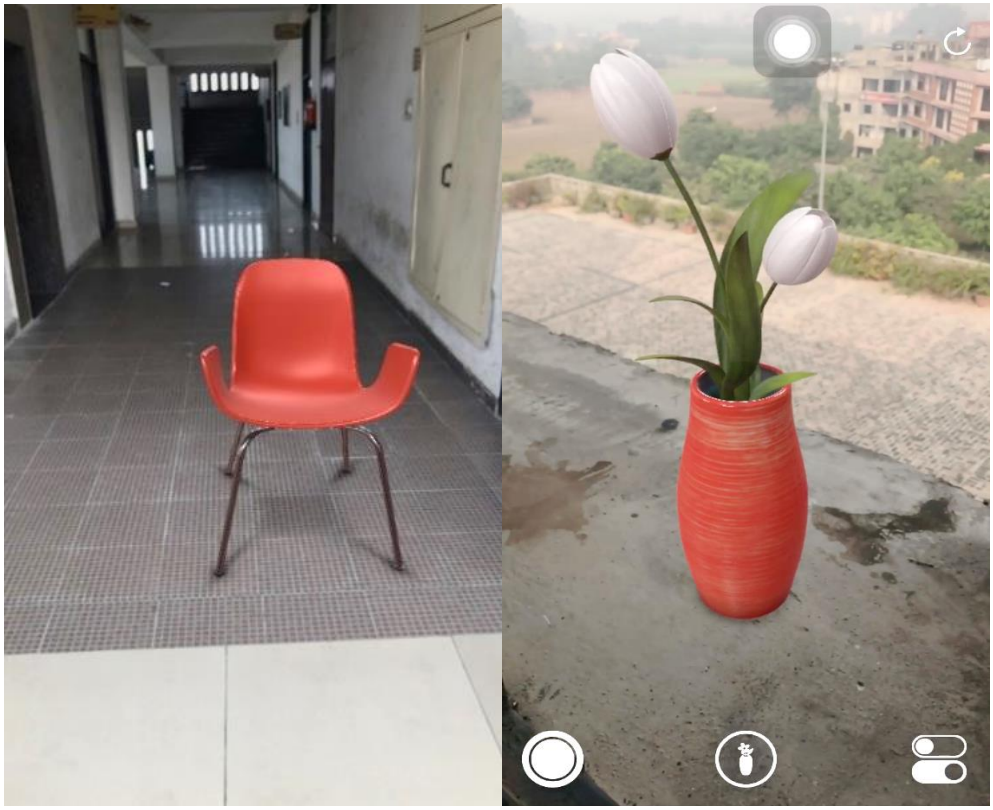


*Fig.11 Object placed on respective surfaces*

## 5.2 LIVE CASE STUDY 2

### 5.2.1 Augment A.R. Kit

5.2.1.1 About the Case Study

Platform – Android / iOS

Year Launched - 2017

Developer – Augment Inc.

Devices used – OnePlus 3, 3T, 5 (Android), Apple iPhone 6s, 7, 7Plus (iOS)

Internet Required – Yes

Models available – 50+ Models are downloadable.

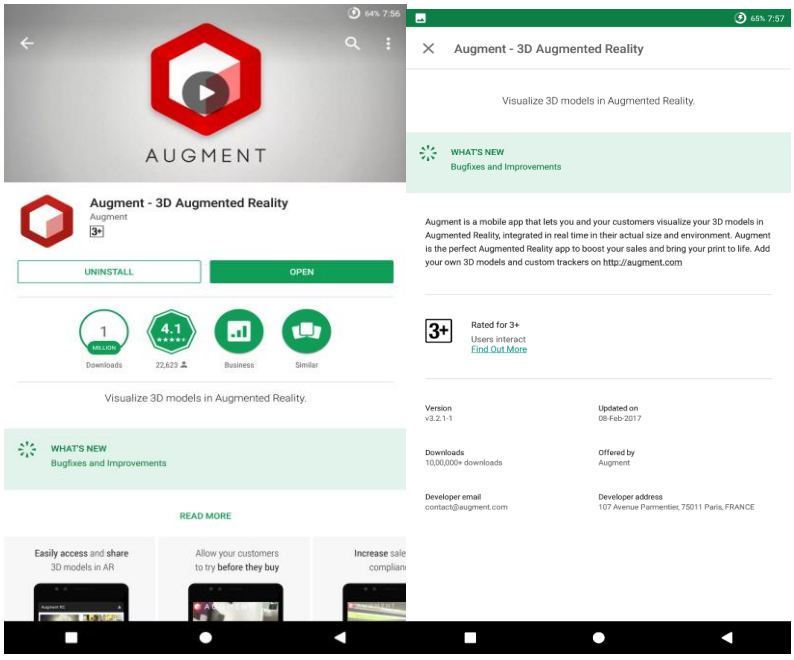



*Fig.12 Screenshot of application on google play store*

*Source – Google play store*

### 5.2.2 Process followed

The app uses motion sensors of device which in this study is OnePlus 5. This tracking technique uses the camera and augmented technology which place the dynamic object virtually in the camera scene with real time moving and zooming functions. Pinch to resize the object, dimensions counting, are the additional features of this application. Process is shown in *Fig.13.*

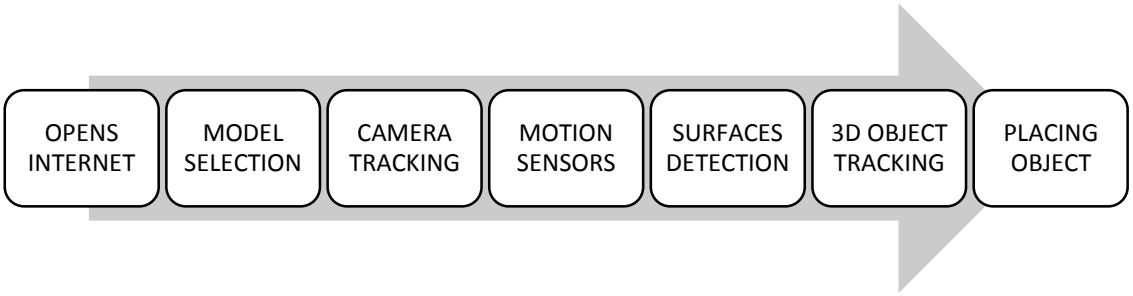



*Fig.13 Flow diagram of process followed*

#### 5.2.2.1 Object Selection

First, the app will ask you to choose one product from its internet databases. There are several categories to choose from like model making, fun based, interiors, machines, famous buildings etc. We need to turn on the internet from very first stage or the app will keep asking to turn on the cellular data.

#### 5.2.2.2 View Detection

This app works with motion sensors and camera functions so, it detects the whole view and until you see that red bar saying "*Not Good Tracker*", it will not place the object. It

will give idea if motion sensors are moved by making the red bars yellow and start saying "*You Are Close*". Both cases can be seen in *Fig.14.*

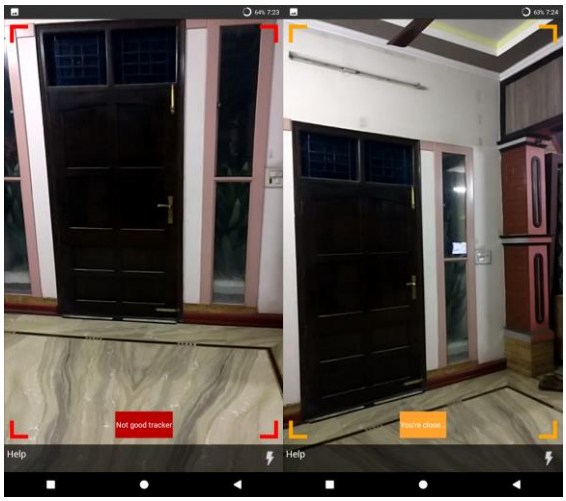



*Fig.14 Sample scene chose for experiment*

5.2.2.3 Surface Detection and Object Placing

It will turn green when it finds the area suitable for object to place the object and then the object will be placed automatically as shown in *Fig.15* ."*Object can be pinch to zoom in or zoom out*". It means we can resize the object by simply pinching the screen.

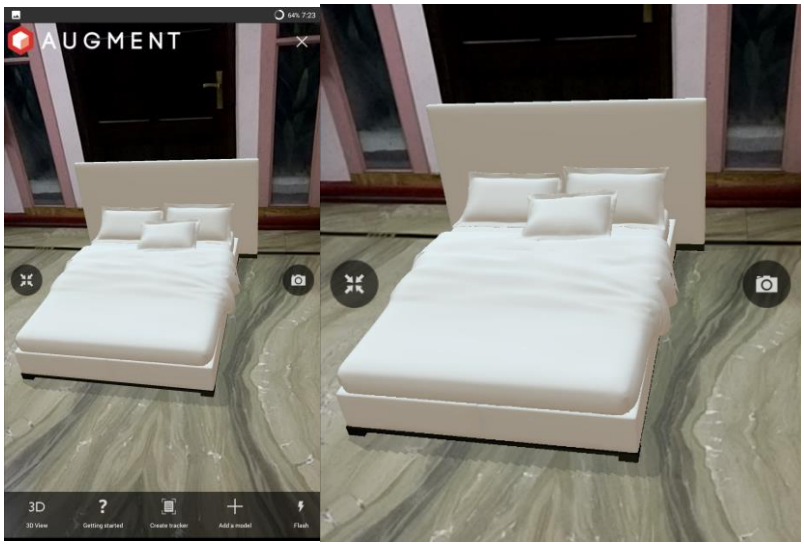



*Fig.15 Virtual bed placed on chosen scene*

## 5.3 Analysis

After studying several different augmented reality applications with different devices as well as operating systems, the major analysis is that the grid system used by A.R.Explorer has proven much better in practice. All the object placed under grid system are more realistic and gave smoother experience. The applications worked terrific under low light as once grid is recorded, the object will follow that grid not the camera. Pinch to zoom for resizing the objects worked fine. Shadows of objects worked smoothly and didn't lag as well. The applications were tested on low end to high end devices i.e. Samsung Galaxy A5, Samsung Galaxy s7, iPhone 4s, OnePlus 2, OnePlus 3, OnePlus 5, iPhone 6s ,iPhone 7 , Samsung galaxy tab 2 , iPad mini. It worked pretty well on all the devices as these days all the mobile phones has decent megapixels in their cameras. One other advantage is that we can cast our screen through Wi-Fi to our big screen L.C.D. Television to get better clearer image.

# CHAPTER 6 - INFERENCES

We need light to see everything so it a crucial part. In building interiors, Natural and artificial lighting are main parts of building. For natural light we can plan accordingly but what about night time and overcast days. At those times, artificial lighting plays vital role in building interiors which puts lots of effects on human being, health and performance. So choosing right amount, place, type and color of lighting is so important. As we know electricity is a form of energy so, placing unknown no of luminaries without any purpose and without knowing its needed intensity, is just a waste of energy and resources. To save that energy we need to consider some tools and that tool is technology.

Technology is so advanced these days and it is the key to build a healthy, sustainable and hazel free future life. There was a time when technology was only limited to computers and high end smartphones. But now in 2017, technologies like augmented reality and virtual reality is accessible on every mid-range smartphone used from a kid of 12 years to old man of 75 years. Everyone know how to work with these technology or maybe need some little tutorial but that is easily usable. New technologies should be functional and used to make life easy instead of just fun and entertainment purpose. This can be easily done with mobile applications as A.R. and V.R. technology reached to everyone by mobile applications so that everyone use them.

# CHAPTER 7 - PROPOSAL

After all the research on augmented reality and lighting there is a proposal of an app which works along with augmented reality to allow users to add real time artificial lighting in their interiors for optimum results. The real time calculation of flux, brightness, glare on particular scene and ability to add artificial lighting appliances through augmented reality. Users can also get suggestions for appliances and need of more light or light is exceeding comfort levels.

## 7.1 Augmented Reality Application Features –

### 7.1.1 Light Visualization

- Light placement will be live and we can see the effect. We can change appliances through the list of appliances available for particular brand. We can put concealed light with definite quantities and see their effect on wall as shown in *Fig.17* or we can apply hanging light to see their effect as shown in *Fig.16.*

*Fig.16 Virtual hanging light in interior*

*Fig.17 Virtual concealed light in interior*

- Can calibrate light and its intensity of light and see the live effect in the view. Low intensity light effect on surrounding elements can be seen as shown in *Fig.18.* High intensity lighting and its effect on surrounding can be seen live as shown in *Fig.19.*

*Fig.18 Low intensity light*

*Fig.19 High intensity light*

- Can calibrate color tuning as we can choose from warm, neutral or cool light by exact color temperature we want. We can the colors by live view and also its effect on existing paints as shown in *Fig.20.*

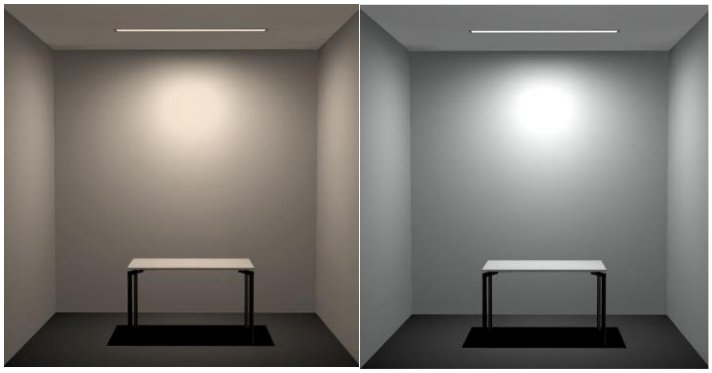


*Fig.20 Warm, Neutral and Cool colored lighting effect*

- Appliance list by the manufacturer like Syska, Philips etc can be scrolled and find the exact lighting product from the brochure as shown in *Fig.21*. If the app is 3rd party app then we can add 3rd party list of all brands appliances and with sorting options.

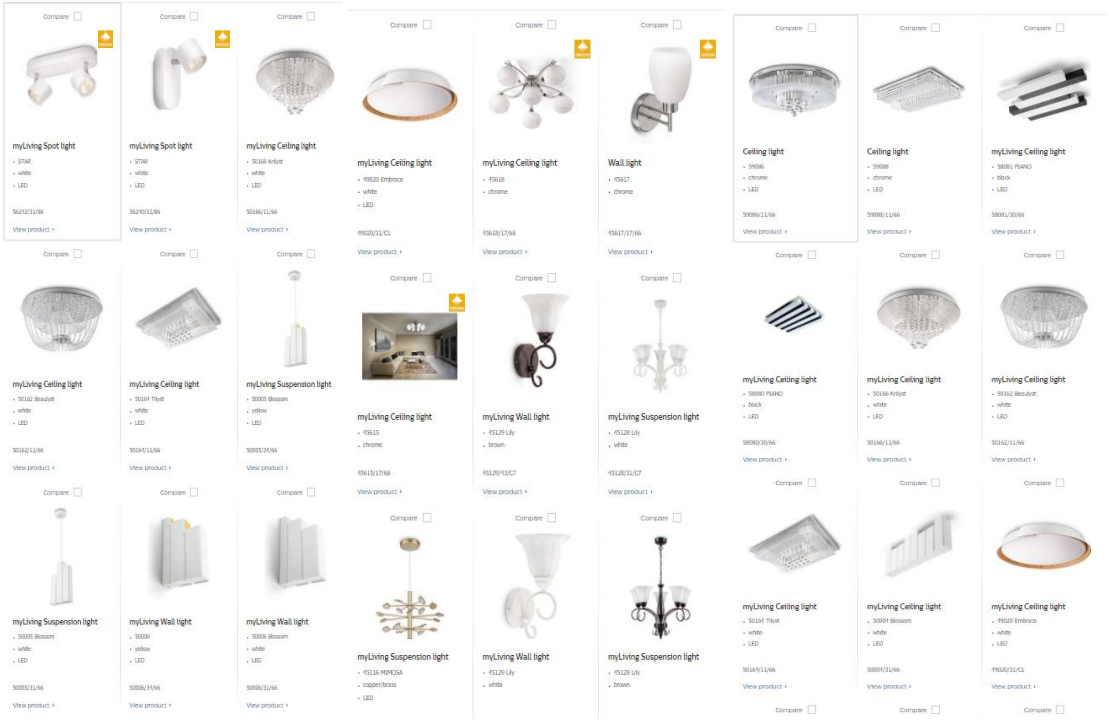


*Fig.21 List of 3d models available in brand catalogue*

### 7.1.2 Furniture scanning

- Scanning of all the furniture and give recommendations.
  - Type of furniture and according lights suggestions. For example if application scans a study table it will show the suggestions of study task light. If console table then it will give recommendation of hanging light or concealed light.

### 7.1.3 Existing light scanning

- New appliance placement.
- Wrong placement of old fixture warning.
- Wrong color tone used warning.

### 7.1.4 Contextual Scanning

- **Recommendations according to existing theme**
  - If we open the application and scan a kids room for example. It will scan all the colors and wallpapers and give recommended device list which will have all the funky, playful, cartoon characters of wallpaper lighting fixtures. It will be in color schemes of room interior or contrasting colors. We can also customize the appliance as everyone wants customization these days.
- **Interior style matching**
  - It will scan the interior of building and all the design elements too so that it can give best recommendations. If the building interiors has straight lines it will give suggestions of matching furniture with rectangular or square shape. If the interiors have more curves and ornamentations, it will pick the ornamented suggestion list to choose the appliances.

## 7.2 Working of mobile application

Working of mobile application will be easy as there are many augmented reality application on the app store for iOS and play store of Android OS. This app will also follow same steps and some additional steps too.

### 7.2.1 Catching the need of user

Starting page of mobile application will be account making as all the interior images can be misused. So all the data stored will associated with the account made by user and remains confidential. Second page of application will be obvious tutorial for layman. We can see the tutorials, case examples, online tutorial videos and 24x7 chat help. Next page will be a questionnaire kind for user which will help the application to work in detail and help the user more.it will ask some basic questions with multi choices to examine the user's need and work accordingly. For layman there is always a skip option available. These questions will be like –

- New lighting design or existing lighting merging.
- Live display of appliances or calculation of fluxes only.
- Typology of building. (Residential, commercial etc.)
- Need of lighting type. (Concealed, cove etc.)
- Lighting color choice. (Warm or cool)
- Appliances brand list. (Filter the brands or show all )

After all the information stored, the mobile application will open the camera and start its work.

### 7.2.2 Data Collection for scene scanning

In real world there are many objects which can be used as source of data collection for augmented reality to work.it contains many objects, furniture, walls, ground, ceiling, people etc. The moving elements or many objects can also be a distraction but more objects usually works positively and improve the user experience. One problem is interference of vision i.e. when some other subject covers the camera and distract the application info but still most of the times it works and works well. This problem can be solved by user as user can make the area presentable for augmented reality to work. Other than user's help, virtual reality can be used in some scenarios as it can scan the room and make a conceptual 3d wireframe and then renders it with proper light calculation.

It will scan the paintings, wallpapers, paints, fans, ceiling design, flooring design, existing lighting, furniture style, colors in interior etc. All the information of house interior will be confidentially stored in user account protected with password.

### 7.2.3 Dot tracking

The invisible dots finds the surface and counts the distance in real time which can be seen if you turn on the visuals. The surface finding can be little tricky as this needs proper view of camera for app to find the proper X, Y, Z Coordinates. It creates tricolor

digital coordinates as shown in *Fig.22*, which makes it easy to make a virtual surface track. Fig.22 are the two default scenes taken for a demo of app proposed.

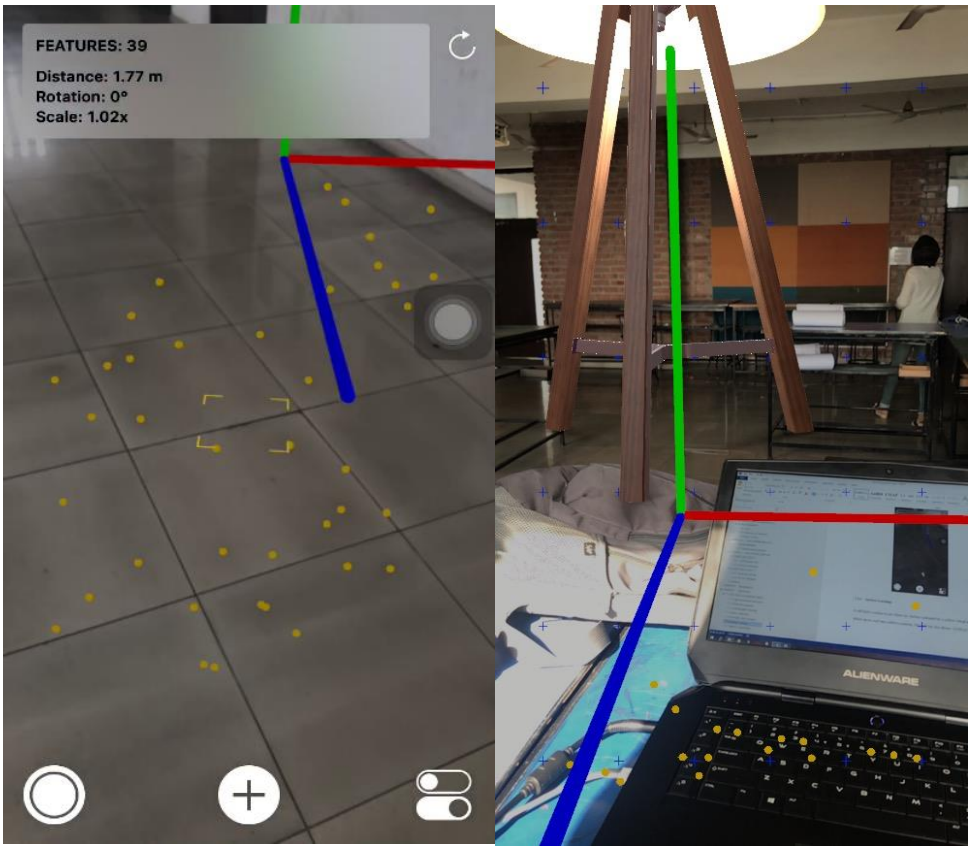



*Fig.22 Virtual coordinates X, Y, Z. with dot tracking*

### 7.2.4 Surface tracking

It will find a surface to put object on. Surface indicated by a yellow virtual square which shows real time surface scanning. The info bar also shows '*SURFACE IS DETECTED'* on success.in following picture we can see that yellow square as shown as *Fig.23* .which reflects the surface selected.it will also count the dimensions of surface in the units user wants.


*Fig.23 Surface dimension counted by application*

### 7.2.5 Object tracking

Then the shadow part is counted by the grids. Then we will get the option of *'ADD OBJECT'* and we can easily place the object on it as following picture has a Virtual Lighting Lamp on that earlier selected surface. The shadow, flux, light intensity etc. will be counted and it will reflect on other surfaces too.

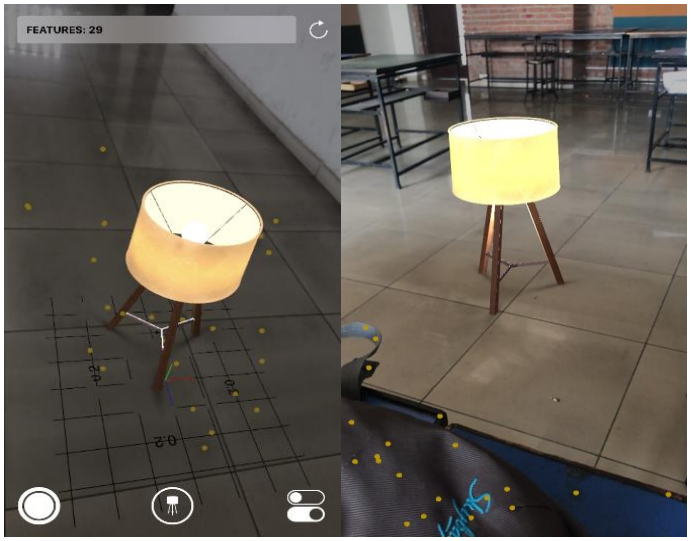



*Fig.24 Virtual lamp placed on respective surfaces*

### 7.2.6 Counting Lighting effects

It will make wireframe light rays which will be dynamic light rays. Intensity, directions, spread and shadows everything will be calculated as shown in *Fig.25*. Wireframe effect can be seen and turned off or on accordingly.

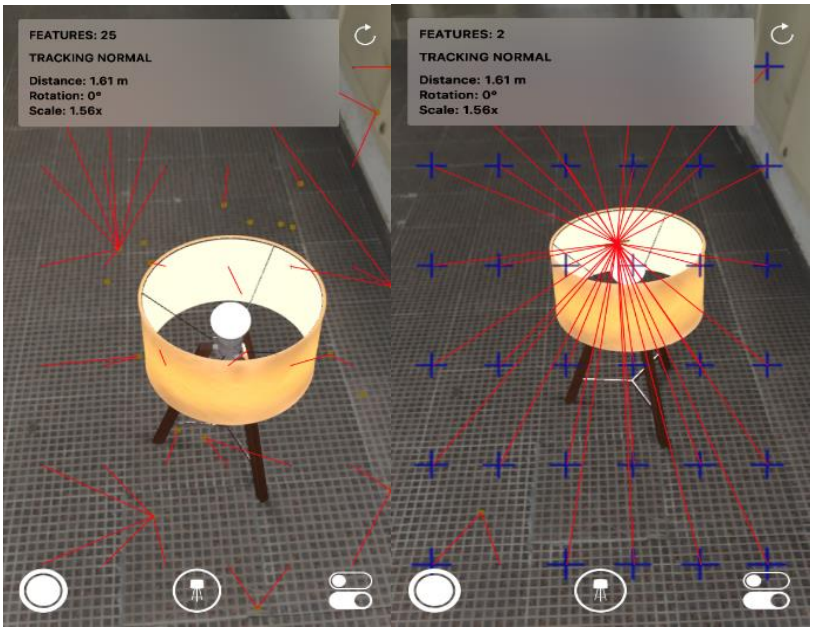



*Fig.25 Red lines showing effect virtually*

### 7.2.7 Final output

Final output will be showing the effect on wall and surrounding area which can help the user to examine the effect. The lighting will depend upon the colors of surrounding elements like paint, wallpaper etc.in *Fig.27* we can see the effect of table lamp on wall, table and surrounding scene compared to default scene in *Fig.26*

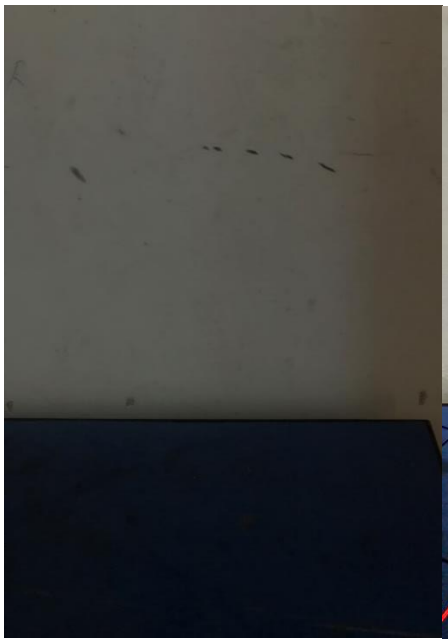


*Fig -26*

*Picture of scene without light*

*Fig.27*

*Picture of scene with light*

**Calibrating intensities**

*Fig. 28*

*Calibrated less intensity*

*Fig.29*

*Calibrated High intensity*

# CHAPTER 8 - CONCLUSION

## 8.1 Final Words

Lighting is a big part of life which can change the future of mankind. Lighting can make an area look good or bad but sadly there is no way right now which can make the lighting design innovative and informative. In questionnaire analysis most of the people have problems in their existing lighting at their homes. Most of the people admitted that they didn't took help of lighting professionals to design their home lighting so most of the work spaces and the lighting is not calculated. Mostly it is done by the electricians with just an idea through their experience and that is why we are facing many issues regarding our health, behavior and performance but we don't know what to do.

Proposed solution i.e. augmented reality can change the life of people become improving their lighting conditions in homes. Mobile application can help to make lighting industry revolutionized by counting number of appliances and their intensities right on their hands. This can be used in new houses to calculate the new lighting needs or in existing areas where users are facing problems like headache, stress, irritation and poor performance. It will improve the health and the performance of the user as well as keep them fresh and stress free during their work period or relaxing time in their house. Other benefits can be like users can have live display of whole range of appliances a company like Philips or Syska has to offer .User can see, experience or even user can see their effects on existing furniture, wall paints or wallpapers in their home. Suggestions will help the layman to choose perfect light which is matching with their interior theme and furniture style.

## 8.2 Future Scope

Lighting is a vast topic as artificial lighting is the crucial part of home interiors which puts lots of effects on users. There is a new technology prosed which can make the lighting more functional, suitable and usable for the occupants but still there are many chances for future expansion. Technology is improving and changing rapidly. New hardware and software make technology more advanced day by day .There is vast scope of continuous advancement with new technologies and new gadgets.

### 8.2.1 World of customization

Everyone loves customization and many vendors are working within this direction. Urban Pitara is an exclusive example which print customized designs on shoes, clothes, frames, mobile cases etc. In future we might be able to make lighting appliances according to our mind. We can upload sketch or give photo or even concept of the lighting appliance to the application and product designers will make 3d samples of that product. We can choose the best one and order it online with light color and intensity we want. Obviously we can again try it our application for live sample and then finalize and order it with advance payment.

Example – If we want a shell shaped hanging light which is not available in design brochure of that brand. We can sketch it or we can just upload picture of shell we want to make light appliance of. Then the product designers can show us several models of that shell design which we can customize like Light type (Hanging or wall mounted

etc.) , light color , wattage of bulb inside , surface finish , surface print etc. We can then try our customize product in application and then select one and order it online.

### 8.2.2 Interior A.R. Application

There is a scope of 3d visualization of whole interior of house. Lighting application makers can combine team of interior designers and make a mobile application with paid home interior themes. User will just scan the room and a digital plan will be sent to online portal where designers can design your interior online. User will get suggestions of planning according to natural light, windows, door and lighting. The application might give you the 3d rooms with many themes available for example a kids room will have many themes like Tom & Jerry , Pokémon etc. and whole interior wallpapers, paints, flooring , ceiling , lighting appliances and furniture will be preset to it and can be visualize in minutes. This will help to make the building designs easy and designers can work with live portal from anywhere and help to make interior design anywhere on globe. This will help to make a customizable world where everyone can choose any interior design they want.

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