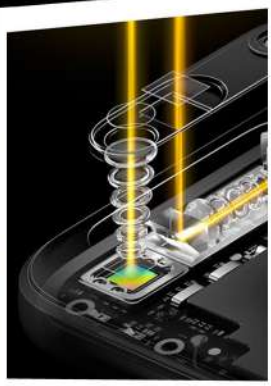
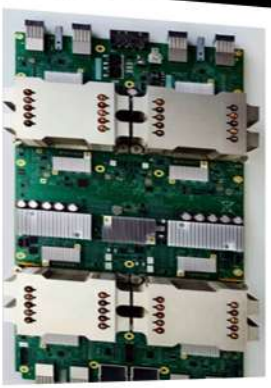
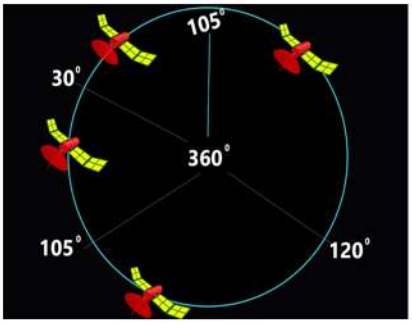
NEWTON'S APPLE







INDIA'S 2020 AGREEMENT
GEOSPATIAL COOPERATION AGREEMENT (BECA)

WHY ART OF PERSUASION ?

2020 DECEMBER EDITION

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Preface

Dear readers,

Welcome to the comeback edition of our departmental magazine. It gives us immense joy and satisfaction to finally re-introduce the " Newton's Apple ".

In this edition, we have tried to bind together the topics from diverse fields to give you an intriguing experience. It represents the creative side of our students to a fair degree - something that we all need to reconnect with, admist our busy schedules of semester exams and all those assignments that often make us bang our heads against the wall.

We thank all of those who stood by us patiently and helped in the development of this comeback edition of our magazine when there were days on which the only thing we had to offer was our own confusion. Be sure to know that there is more to be written and certainly more to be read in the forthcoming editions. So brace yourselves to be amazed and enlightened.

Any suggestions to improve the quality of the magazine would be gratefully received and incorporated in the subsequent editions. Hope each one finds this informative and creative.

Happy Reading !

- Team NEWTON'S APPLE

IN THIS ISSUE

SYSTOLIC ARRAYS and the TPU

Computers have truly transformed our lives in the last three decades. They are now an integral part of our lives. Moore's law has fortunately remained true with emerging VLSI technologies cramming more and more components onto silicon chips. Besides, there has been much advancement in the area of Computer Architecture with the advent of multi-core processors and GPU computing. With each paradigm shift in the computer industry there comes the cost of power constraints, reliability issues and complexity of designs etc. Modern day applications are driven by huge hunger for data (Big data) and AI/ML which has been the dominating trend of the era.

AI Chip Landscape of the modern day.

Systolic Arrays as AI Accelerators

A Systolic array can act as an AI accelerator, especially for artificial neural networks, computer vision and machine learning as discussed later in the article. Today, we are very much bounded by the energy consumption of memory accesses. Mostly, processing of data is performed far away from the memory due to which energy consumption of data movement dominates over the actual computation. This becomes more important in modern day applications such as machine learning applications which are increasingly data hungry. These require rapid and efficient processing of large amounts of data.

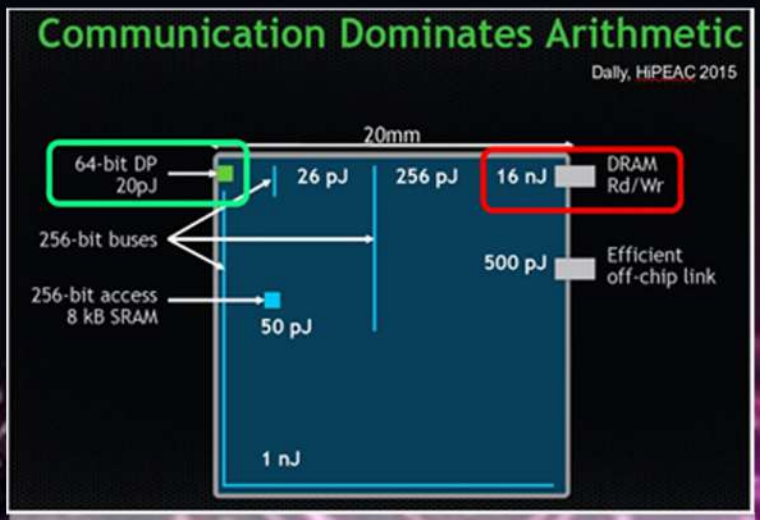


Figure 2: A DRAM memory access consuming 1000X more energy than a 64-bit complex addition.

Data access is really a major bottleneck and energy consumption has been a key limiter. In fact, this bottleneck is analysed by several research works, one of which is 'Challenges for Futture Computing Systems' by Bill Dally, Chief scientist at Nvidia. In his work, Dally has compared the energy consumption of a 64-bit complex addition operation with that of a DRAM memory access. The results show that the former takes 20 pJ on an average as opposed to the latter which consumes 16 nJ. Another work, 'Google Workloads for Consumer Devices: Mitigating Data Movement Bottlenecks' published in ASPLOS shows a similar result. According to this paper, 62.7% of the total system energy is spent on data movement.

Systolic arrays permit multiple computations for each memory access and they do not let energy consumption of memory accesses spike, thus answering the bottleneck. In a systolic system, data flows from the memory in an orchestrated fashion passing through many processing elements before returning to memory. This works like an automobile assembly line where different people work on the same car at different instances and many such cars are simultaneously assembled.

Although assembly lines are linear, Systolic systems may also be two-dimensional. Thus, a systolic array is essentially a set of interconnected cells (each may also contain private memory and can even be a simple processor) or processing elements, each performing a specific operation. Data flows from one cell to another in a pipelined fashion. The basic principle of a Systolic array is illustrated in Figure-3. One of the biggest advantages of the Systolic architecture is being able to use each input data item a number of times.

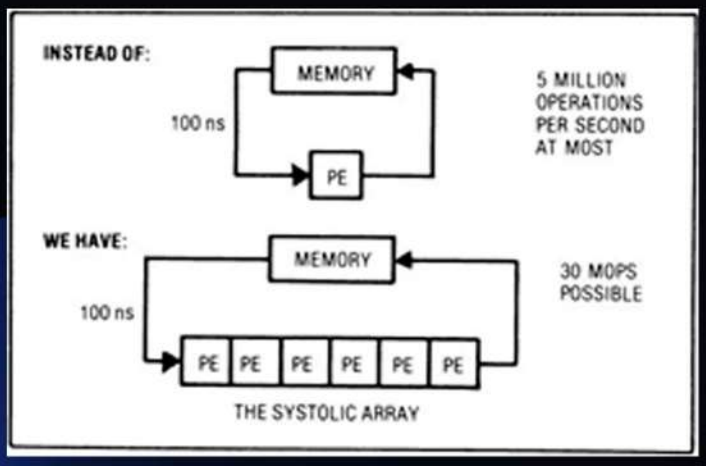


Figure 3: Basic principle of a Systolic array.

Systolic Convolution

Convolution is one of the fundamental operations in machine learning (Convolutional Neural Networks). This is used in filtering, pattern matching, correlation and many sophisticated image processing techniques. Specifically, discrete convolution is defined as follows:

Given the sequence of weights {W1, W2, W3....Wk} and the input sequence {X1, X2, ...Xn}, compute the result sequence {Y1, Y2, Y3,...Yn+1-k} defined by:

$$y_i = W_1 X_i + W_2 X_{i+1} + \ldots + W_k X_{i+1-k}$$

This scenario can be a good fit for acceleration. A systolic array may perform this operation more efficiently than any other approach as shown in Figure 4. The figure illustrates a systolic convolution with three processing elements containing weights for convolution. The output sequence contains:

$$y1 = W1X1 + W2X2 + W3X3$$
$$y2 = W1X2 + W2X3 + W3X4$$
$$y3 = W1X3 + W2X4 + W3X5$$

Note that each input data item i.e., Xi is fetched only once throughout the computation irrespective of the length of the desired sequence whereas in a general processor, we fetch each term in the input sequence i.e., Xi for every term in the output sequence.

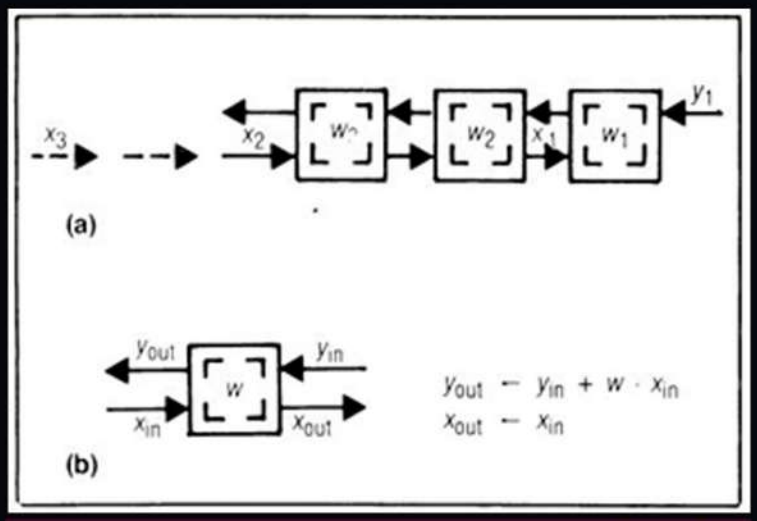


Figure 4: Systolic Convolution Array (a) and cell (b) where weights stay and input and output terms move

Clearly, Systolic array outperforms a general processor in terms of energy consumption of the overall computation. Besides, we can observe that this architecture has very high performance and is attributed by high concurrence since every processing element is multiplying and accumulating some part of the result at a given time as shown in Figure 5. However, one needs to carefully orchestrate while giving the data elements as input to the array and while buffering the outputs. If each processing element performs a complex operation, the PEs may become less predictable in terms of latency which makes these designs complex. One needs to know how to schedule the operands coming into the array based on the latency of each processing element for successful computation of the result. Besides, these architectures are not generally applicable as the computation needs to fit the PE functions. For example: 'Multiply and Accumulate' in above scenario.

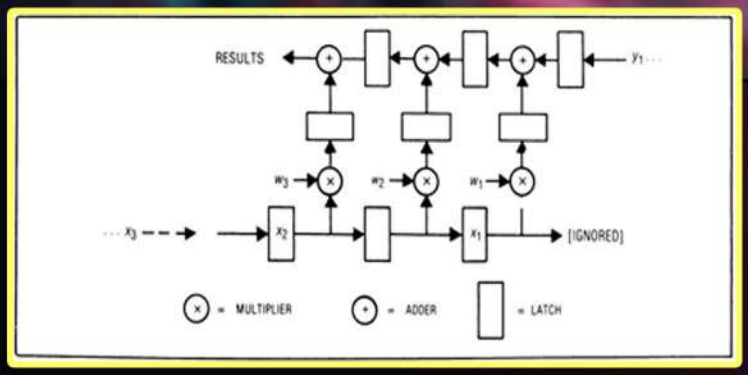


Figure 5: Overlapping the executions of multiply and accumulate.

It's essential to realise that the processing elements in a systolic system can store multiple weights (W) and can also be programmed to select a Weight (W) on the fly. This eases the implementation of adaptive filtering as a use-case scenario. Let's say we have an image processor and you want to blend a given colour with some colour which is of some weight or with some other colour of a different weight.

Now you have a choice between these two colours by choosing the appropriate weight that you apply to the pixels. The same applies to a neural network. If we extend this further, each PE can have its own data and instruction memory to store intermediate results which leads to a concept called as pipelined parallelism.

Modern Systolic Systems

Systolic arrays were first introduced as a part of Warp computer architecture in 1987. More recently, Google deployed two-dimensional systolic arrays in their data centres acting as the heart of the Tensor Processing Unit. A TPU is a hardware accelerator specialized for deep learning tasks. It shortens the training time by performing matrix multiplication in the hardware. The array has been realised as a 65,536 8-bit MAC matrix multiply unit that offers a peak throughput of 92 TeraOps/second (TOPS) as stated by the paper, 'In-Data centre Performance Analysis of a Tensor Processing Unit', Google Inc. The paper also states that the TPU is on average about 15X-30X faster than its contemporary GPU (Nvidia K80) and CPU (Intel Haswell) with TOPS/Watt about 30X-80X higher. According to the authors, the matrix unit uses systolic execution to save energy by reducing reads and writes of the unified buffer shown in Figure 6. Figure 7 shows that the systolic data flows in from left and weights are loaded from the top. A given 256-element multiply-accumulate operation moves through the matrix in an overall diagonal fashion. The software running on the TPU is unaware of the systolic nature of the matrix unit but may worry about the latency of the unit for performance.

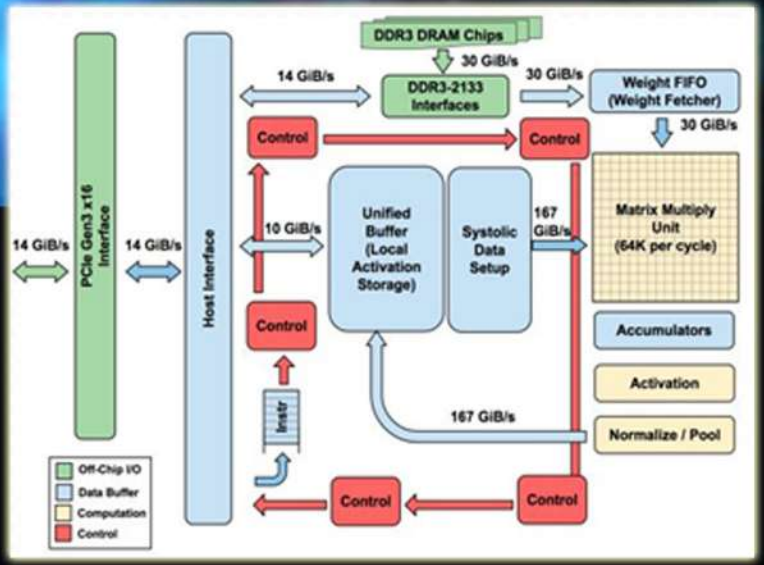


Figure 6: TPU Block Diagram. The main computation is the yellow Matrix Multiply unit. Its inputs are the blue Weight FIFO and the blue Unified Buffer and its output is the blue Accumulators. The yellow Activation Unit performs the nonlinear functions on the Accumulators, which go to the Unified Buffer.

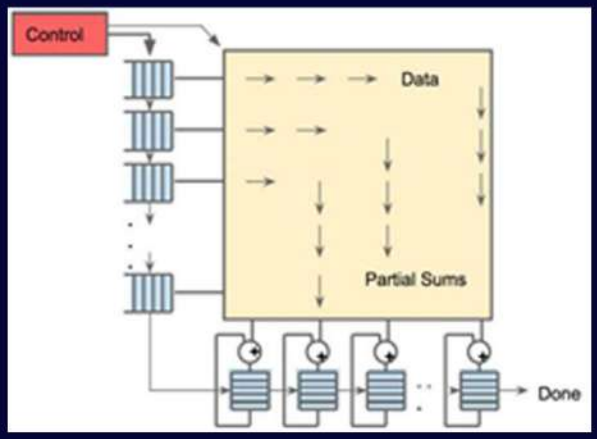


Figure 7: Systolic data flow of the matrix

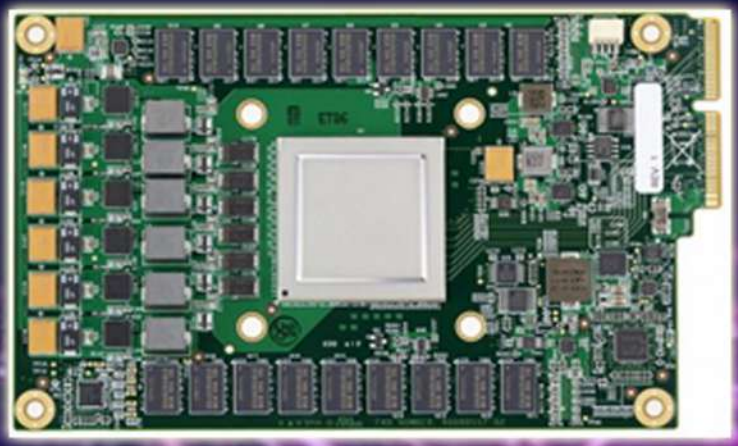


Figure 8: TPU1 Printed Circuit Board.

What's bfloat16?

The AI research group at Google, the 'Google Brain (b in bfloat16)' developed this peculiar number format aimed at optimizing machine learning algorithm execution. There are a couple of things that make bfloat16 multipliers optimal for deep learning algorithms. Firstly, the range of a bfloat16 multiplier is reportedly very close to that of a 32-bit IEEE floating-point multiplier. This ultimately gives rise to higher performance and lesser storage with very less probability of Overflow and Underflow errors when converting from a Float32 (fp32). Figure 9 shows that this format retains all the 8 bits of exponent as of fp32 while the mantissa is truncated to 7 bits. Secondly, bfloat16 multiply accumulators (MACs) operate in mixed precision. Input values are of bfloat16 and the multiplication is performed between these bfloat16 inputs resulting in a float32 accumulation and hence the result out of a MAC unit is in float32 format. What's more interesting is that the TPU handles this conversion automatically and we don't have to make any manual adjustments to the code. Lastly, the area occupied by a bfloat16 MAC unit is almost half that of a float16 multiplier and one-eighth of that of a float32 MAC unit. This in turn increases the density of MAC units in the Systolic array while decreasing the training time for a given deep learning model.

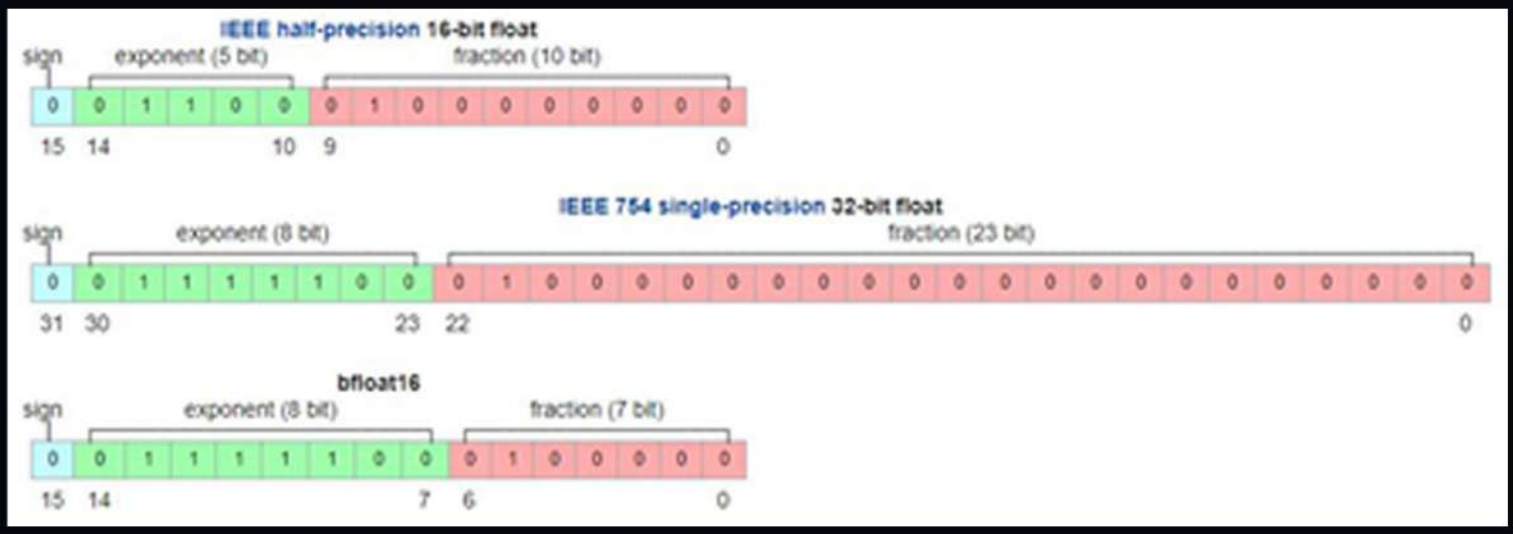


Figure 9: Number format comparison between IEEE 754 and bfloat.

A neural Network has two phases. They are training (or learning) and inference (or prediction). The first model of TPU was designed only for the phase of inference while its second generation has been designed for both training and inference. The second generation TPU contains four TPU chips vs. one chip in TPU1 as shown in Figure 10. Each chip can perform 45 TFLOPS (Tera Floating Point Operations per second) as opposed to TPU 1 which only performs 23 TOPS.

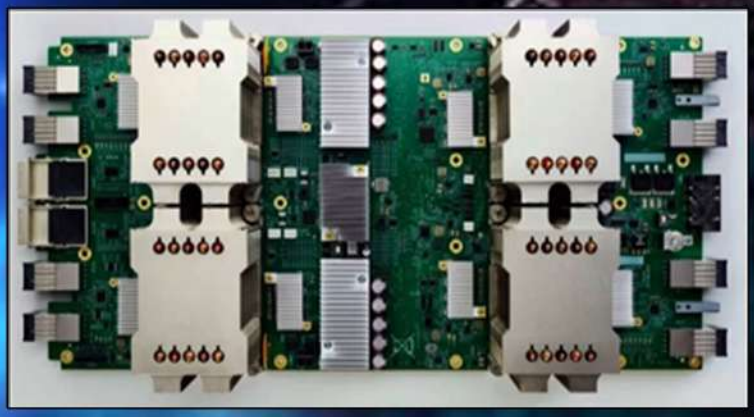


Figure 10: TPU2 with four TPU chips.

To wrap up, the convolution problem is just one of the many computational scenarios that can benefit from the systolic approach. We also observe that Systolic systems are very different from General purpose computers and require compilers of their own. Nevertheless, these are being leveraged by tech giants like Google in critical data centre applications. This shows us that for a specific set of desired goals, full-system design should be the only way forward and we must look at the problem from a full-system perspective. This is because our system may require some latency and energy guarantees that the other off-the-shelf processors may not be able to provide.

- C. Neeraj Kumar
1602-18-735-081

ALLURING INDIAN ARCHITECTURE

One of the most enduring achievements of Indian civilization is its architecture. The undisputed glory of this architecture is evident in the form of Caves, Temples, Palaces and Stupas. This incredibly rich heritage has evolved over nearly 4000 years. This evolution is the result of socio-economic and geographical conditions. Moreover, the fact that 26 out of the 860 World Heritage Sites listed by UNESCO belonging to India makes it an epitome of architectural heritage.

Origins of Indian Architecture

Indian architecture belongs to different periods of history and bears the stamp of respective periods. Though the cities of Indus Valley civilization provide substantial evidence of extensive town planning, the roots of architecture in India can be traced back to the advent of Buddhism in India. With the establishment of Hindu kingdoms in the south, the architecture began to flourish. The Pallava, Chola, Hoya Sala, and Vijayanagar rulers did a remarkable job in the field of architecture. Whereas in the northern part, a new style of architecture was developed which was called the Nagara style. Then by the coming of Mughal rulers, there developed another architectural style – the Indo-Islamic style. It was followed by the Indo-Saracenic - a result of colonization in India.

Chronology of Indian Architecture

The buddhist Architecture

Buddhist architecture began with the development of various symbols, representing aspects of Lord Buddha's life. The Indian emperor Ashoka opted for the architectural monuments to spread Buddhism in different places. The major features include Stupas (Domes), Stambhas (Pillars), Viharas (Monasteries), Chaityas (Caves). These architectures were the first to use rock-cut architectures.

*• **Stupas:** The Buddhist stupa serves as a marker for a sacred space, a symbolic representation of the Buddha's burial mound. The ashes of the Lord Buddha are buried in stupas built at locations associated with important events in Buddha's life such as Lumbini (where he was born), Bodh Gaya (where he achieved Enlightenment), and Kushigata (where he died). The choice of these sites and others were based on both real and legendary events.*

The Great Sanchi stupa was originally commissioned by the emperor Ashoka in the 3rd century BCE. Torana is a sacred gateway in Buddhist architecture. These Toranas are commonly associated with Buddhist stupas. The Great Stupa of Sanchi has Toranas on four sides.

*• **Stambha's:** Stambha's are the free-standing monolithic columns erected over selected sites because of their sacred associations.*

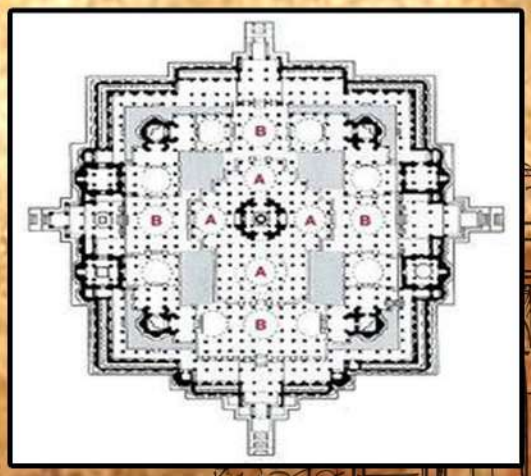
- ***Vihara's:*** *Vihara is a monastery arrangement of cells for the accommodation of monks. These are generally built using wood or bamboo. After the 1st century AD, they were converted into educational institutions.*

- ***Chaityas:*** *Chaitya is a Buddhist prayer hall with a stupa at one end. It is made mainly for large gatherings for devotees. These were influenced by the ascetic lifestyle of the Vedic period.*

The Jain Architecture

Jain Architecture is the offshoot of Buddhist and Hindu Architecture. At first, many Jain constructions were made neighbouring to the Buddhist rock-cut styles. However, later they started the construction of their structure on mountains based on the theme of mountain's immortality.

Jain temples have many pillars with a well-designed structure, forming squares. Hence, the chambers were created, which lead to the formation of chapels that contain an image of the deity. The pillars on the roofs are omitted to form an octagonal space with a pointy dome. The only variation in Jain temples is a ***four-faced*** *or* ***Chaumukh design.***



The Sikh Architecture

Sikh Architecture is a style of architecture that is characterized by values of progressiveness, exquisite intricacy, austere beauty, and logical flowing lines. It is majorly influenced by the Mughal and Rajput architectural styles. Sikh architecture also comprises forts, colleges, and palaces apart from religious constructions. These religious structures of Sikhs are known as gurdwaras. These gurdwaras are a remembrance of their gurus.

To Illustrate, Gurudwara Dera Sahib, in Batala was constructed in commemoration of their guru- Guru Nanak. One of the most famous Sikh architectures includes "The Golden Temple". Its upper half was made with copper and covered by a 400-kilogram gold leaf to bring about its purity and beauty. The lower half is in marble and is one of the most endorsed materials apart from red sandstone which was used by the Mughals in specific. Thus it came to be known as ***Golden temple.***

The Hindu Architecture

The Hindu Architecture evolved from rock-cut shrines to ornate and massive temples. This type of architecture mainly consists of temple constructions. Hindu architecture is a traditional Hindu system of temple architecture, monasteries, mausoleums, and other architectural religious buildings of Hinduism. The science of Hindu architecture in India is described in Hindu texts — Vastu Shastra and Shilpa Shastra deal with forming statues, icons, stone murals, painting, and other..

"The history of symbolism shows that everything can assume symbolic significance: natural objects (like stones, plants, animals, men, mountains and valleys, sun and moon, wind, water, and fire), or man-made things (like houses, boats, or cars), or even abstract forms (like numbers, or the triangle, the square, and the circle). In fact, the whole cosmos is a potential symbol."

—(Carl Gustav Jung)

The beauty of Hindu Temples lies in their fractal geometry. The idea that temple architecture has a progression of detail from a large to small scale is accepted. But fractal analysis provides a quantifiable measure of progression of detail, also quantifying the mixture of order and surprise in a rhythmic composition. Hindu temple is one of the best exatmples of those fractal buildings which were constructed in the past, long before the birth of fractal theory and manifested the religious cosmic visions.

Temple Architecture

Temple architecture in India developed in almost all regions during ancient India. The Ancient temples in India can be classified into 3 categories-the Nagara or the northern style, the Vesara or the mixed style, and Dravida or the southern style. These classifications are based on different architectural styles employed in the construction of the temples. The areas of Hindu temple sites are most of the time near water bodies, in nature's lap.

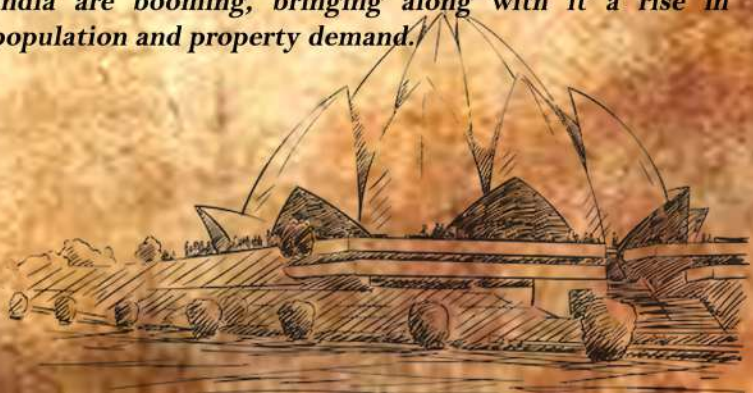
Basic Elements in Temple Architecture:

1. *Garbhagriha: The womb chamber*
2. *Mandapa: It is a pillared hall in front of garbhagriha, for the assembly of devotees.*
3. *Shikara: The tower or the spire*
4. *Amalaka: The fluted disc like stone placed at the top of shikara.*
5. *Kalasha: It is the top most point of the temple.*
6. *Antarala: Intermediate chamber.*
7. *Jagati: It is the raised platform for praying.*
8. *Vahana: It is the vehicle of temples main deity along with the standard pillar.*

One of the earliest foreign influences on Indian architecture stemmed from the Mughal reign in India that spanned the sixteenth, seventeenth and eighteenth centuries. The Mughal architecture was a composition of Islamic, Persian, Turkish and Indian architecture, and was defined by symmetrical patterns, bulbous domes, long minarets and imposing gateways.

MODERN ARCHITECTURE

Modern Indian architecture still honours and upholds the traditions of India, but the architectural form works to better meet the needs of modern-day society. Modern Indian structures did not even start coming around until after India gained independence from the British in 1947. The industrial revolution played a major role in the development of the science of architecture that was driven by functional priority. Today we see a traditional character in Indian architecture, but with modern form and style. Buildings are less ornate and more expressive in form. Materials are basic but innovative. The use of steel and glass to erect innovative building forms is extremely popular and striking in the landscape. Urban centres in India are booming, bringing along with it a rise in population and property demand.



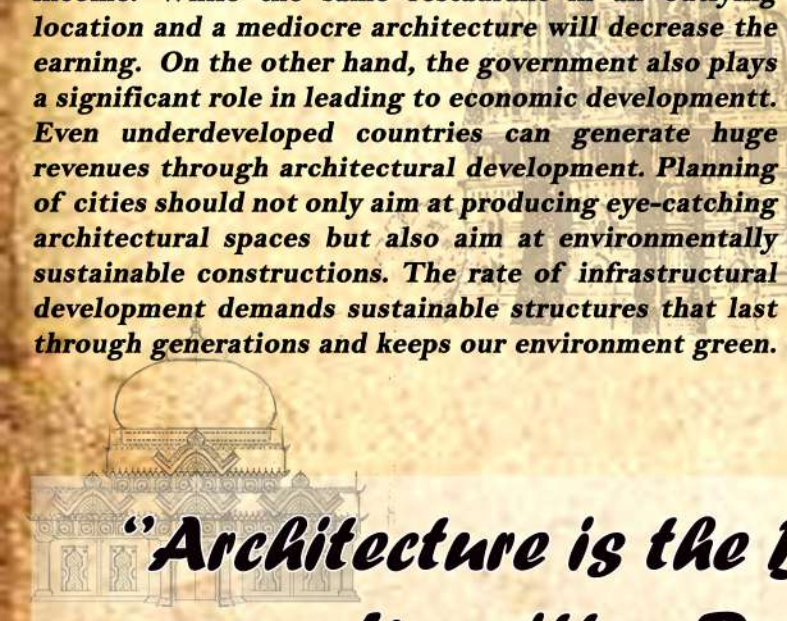
ARCHITECTURE CONTRIBUTION TO ECONOMIC DEVELOPMENT

Architecture has always been an attraction, inspiration, and a part of economic development. For instance, a restaurant with a good location & beautiful architecture always attracts customers, increases income. While the same restaurant in an outlying location and a mediocre architecture will decrease the earning. On the other hand, the government also plays a significant role in leading to economic developmentt. Even underdeveloped countries can generate huge revenues through architectural development. Planning of cities should not only aim at producing eye-catching architectural spaces but also aim at environmentally sustainable constructions. The rate of infrastructural development demands sustainable structures that last through generations and keeps our environment green.

WHY IS ARCHITECTURE STILL RELEVANT Today?

Architecture not only affects society on a high level but also on a more personal level, it can have a profound impact on its occupants. Everything from the layout of the space to the material finishes can contribute towards occupant health, mood, and productivity. It's been shown that people who work in well-designed spaces take less sick leave, are more focused, and contribute more to their company. Sterile, concrete landscapes and unimaginative buildings cause higher levels of stress. Designing buildings, as well as cities, to combat this, whether it be beautiful, awe-inspiring architecture, or simply a mindful connection to nature, helps humans to feel more relaxed, happy and engaged.

Isn't the architecture of India a fusion of many architectural styles? Didn't Indian architecture make us proud? Whenever you visit a monument or a temple next time, focus on every detail, observe the well-planned placementst and design. They just leave you surprised and it turns out to be a memorable visit.



"Architecture is the Biggest Unwritten Document of History"

- Keerthi
ECE-A-19-015

Cameras in your Smartphones

In our day to day life, smartphone became major part of our daily life activity. we use smartphone for various purpose. Many of us click photos and upload it on social media. Do you know that how your phone camera is clicking a shot that u want. This article gives u a brief idea about how camera works and its terms.

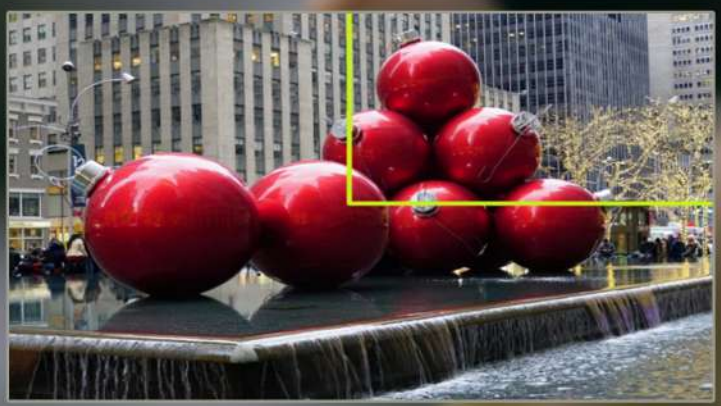
Cameras that we have in present generation phones are of various types. Let us discuss about their types.

Major types of cameras we use are:

1. Primary camera.
2. Wide angle camera.
3. Telephoto lens.
4. Depth sensor.
5. Macro camera.

1. Primary Camera:

This camera is the major camera of your phone. We listen as 48 megapixels, 32 megapixels etc on tv ads when they feature a phone. Primary camera is used to click major photos. It comes with 64mp or 48mp based on the phone model



The above image is a combination of 64 million pixels that are clicked on a 64mp .

What is MegaPixel?

A minute area of illumination on a display screen, one of many from which an image is composed is called pixel. A unit of graphic resolution equivalent to one million or (strictly) 1, 048,576 (220) pixels is called as megapixel.

In simple words, your photo is the collection million small boxes for which each box has its own colour and collectively show as a picture. If your phone has 64megapixel then the meaning is when you clicked a photo your camera is generating a picture which has 64 million boxes namely pixels and those boxes collectively gives your picture.

Cameras are also equipped A blurry image of a building like optical image stabilization which makes image to click perfect without any blur or disturbance and stabilize the video when u record so that video won't get fluctuated it records smooth.

2. Wide Angle Camera:

This camera clicks photo in wide. If you want to click a group photo so that all should come in pic, this camera makes resolution wide and clicks

A lens is considered wide-angle when it covers the angle of view between 64° and 84° which in return translates to 35–24mm lens in 35mm film format.

Longer lenses magnify the subject more, apparently compressing distance and (when focused on the foreground) blurring the background because of their shallower depth of field. Wider lenses tend to magnify distance between objects while allowing greater depth of field.

Another result of using a wide-angle lens is a greater apparent perspective distortion when the camera is not aligned perpendicularly to the subject: parallel lines converge at the same rate as with a normal lens, but converge more due to the wider total field.

For example, buildings appear to be falling backwards much more severely when the camera is pointed upward from ground level than they would if photographed with a normal lens at the same distance from the subject, because more of the subject building is visible in the wide-angle shot.

Because different lenses generally require a different camera–subject distance to preserve the size of a subject, changing the angle of view can indirectly distort perspective, changing the apparent relative size of the subject and foreground.

3. Telephoto lens:

A telephoto lens increases focal length. It is most commonly used to show far away objects with accurate perspective and with a level of precise detail that was once only possible with close-range photography.

How does it work?

Telephotos Make Subjects Appear Closer to the Camera.

This is the most obvious reason to use a telephoto lens and why most beginners consider getting one. A telephoto lens will allow you to take photos of subjects that are farther away. This comes in handy when you are taking photos of things that you can't, or don't want to, get close to. Having more distance between you and your subject can help some people feel more at ease in front of the camera. A telephoto lens will get you closer to the action. Want to take a picture of dangerous wildlife from the safety of your car? A telephoto lens will let you do it.

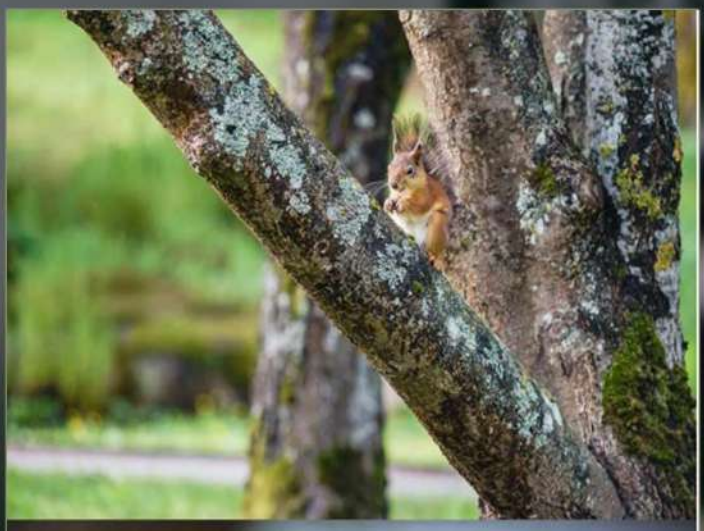
Telephotos also help improve the visual relationship between a subject and its environment by creating the appearance of a kind of compression effect that is similar to how our brains see object-to-background relationships. Mountain ranges that appear to be sitting practically right on top of the cityscape are better visually translated with telephotos than with wide angles. Simply put, telephoto len ses open up your photographic possibilities by making far away subjects appear closer to the camera.

with telephotos than with wide angles. Simply put, telephoto lenses open up your photographic possibilities by making far away subjects appear closer to the camera.

Telephotos Help Emphasize Blurred Backgrounds

If you've ever seen a photo where the subject is in focus but the background is blurred and wondered how that effect was achieved, the answer is often with a telephoto lens. This use is especially common in portrait photography. The way to achieve this look is to shoot with a long lens and the widest aperture available. For example, a 70-200 mm telephoto lens shot at 200 m with an aperture of f/2.8 will isolate your subject against a beautiful, creamy background.

When it comes to deciding which focal length is best for you, it will depend largely on how you plan to use it. Below we'll discuss some common telephoto lens lengths and how and when to use them.



What is the lens focal length ?

Focal length, usually represented in milli meters (mm), is the basic description of a photographic lens. It is not a measurement of the actual length of a lens, but a calculation of an optical distance from the point where light rays converge to form a sharp image of an object to the digital sensor or 35 mm film at the focal plane in the camera. The focal length of a lens is determined when the lens is focused at infinity.

Lens focal length tells us the angle of view—how much of the scene will be captured—and the magnification - how large individual elements will be. The longer the focal length, the narrower the angle of view, and the higher the magnification. The shorter the focal length, the wider the angle of view, and the lower the magnification.

Focal Lengths	Common Uses
70-200mm	portraits, weddings, sports, wildlife
85mm	portraits, weddings
100-400mm	sports, wildlife
135mm	portraits, sports, weddings, wildlife
600+mm	sports, wildlife

4. Depth Sensor:

This camera usually comes with 5mp in phones. It is used to click portrait shots.If you find a phone with a depth sensor, it's designed to do exactly that—sense depth. This means professional-style blur effects and better-augmented reality rendering, through either the front or rear camera.

The depth sensor contains a monochrome CMOS sensor and infrared projector that help create 3D imagery throughout the room. It also measures the distance of each point of the player's body by transmitting invisible near-infrared light and measuring its "time of flight" after it reflects off the objects.

5. Macro Camera:

This camera is used to click objects very closely. It usually comes with 5mp to 10mp. If you've ever seen a picture of the tiny details on a flower or the intricate pattern on an insect and wondered how that photo was taken the answer is relatively simple: with a macro lens. Macro photography is the art of making small objects look life-size or larger. It can render tiny objects with incredible detail not possible with the naked eye or a standard lens. These types of shots can be challenging taking — but also incredibly addictive.

Macro shot by Oneplus pro

Macro vs. Regular lenses

While macro lenses are often used to take photos of things to close up, how they're used isn't actually what defines them. A macro lens can focus from infinity to 1:1 magnification, meaning that the size of the image in real life is the same as it's reproduced on the sensor. The magnification ratio tells you how the image projected on the camera's sensor compares with the subject's actual size, so a lens with a 1:2 ratio can project an image on its sensor up to half the size of the subject while a lens with a 5:1 ratio can project an image five times the size of the subject. Macro lenses also allow for closer focusing distances than normal lenses and often require you to get very close to your subject.

They come with different focal lengths each focal length has its application as below: each focal length has its own application as below:

Focal Length	Approximate Distance from Subject at 1:1 Magnification	Suggested Uses
50mm	20 cm	stamps, coins, jewelry
100mm	30 cm	small insects, flowers, portraits
160mm	50 cm	reptiles, large insects

- Sathwik
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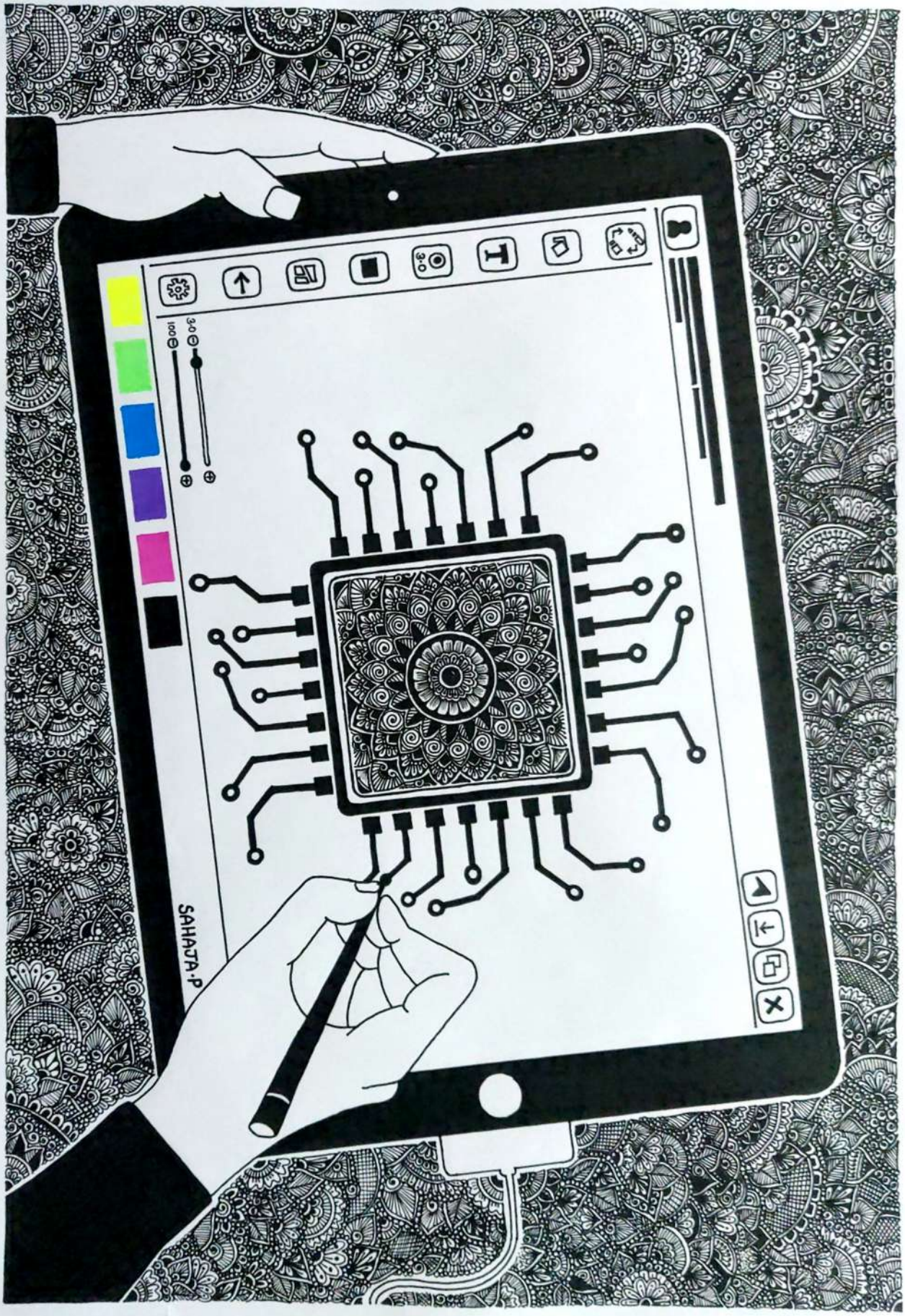

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GLOBAL POSITIONING SYSTEM

Introduction: Something which comes to our mind when we think of satellite navigation is Global Positioning System (GPS). GPS is a system which works for locating a specific set of coordinates or a position on the Earth surface with the aid of satellites.

GPS is used in providing services in mapping, aviation, predicting natural disasters like earthquakes and tsunamis

History:

This was initially developed by the US Military as a Regional Navigation System on the name of Nav Star GPS in the year 1978. In the year 1980, Nav Star GPS has been brought into public service by the US. This was later developed as a fully functional system in the year 1993 with positioning aided by 24 satellites orbiting around the earth. This Nav Star later has been brought into global service as GPS in the year 1995.

Since then, US military has been supplying GPS services to the military bases of other countries as well. Hence US had the authority to stop their services to a country at any point of time. In 1999, during the Kargil War between India and Pakistan, US as a support to Pakistan, has revoked its services to Indian army.

After this consequence, countries like Russia, Europe, China, Japan, and India have started building their own satellite navigation systems. Russia, Europe, and China have built Global Positioning systems while India and Japan built Regional Positioning Systems. Regional Positioning Systems work for the service of a specific country only.

Parts in GPS:

GPS is majorly divided into 3 parts which work as a system to supply positioning services, they are:

- Space Segment
- Ground Control Segment
- User Segment

Space Segment:

Space Segment is technically called as 'GPS Constellation.' GPS Constellation refers to a group of satellites which are supplying GPS services orbiting around earth. According to the present date, there are 33 satellites in this constellation. It is enough to have 24 satellites in the constellation to supply global positioning services. The excess 9 satellites supply backup services.

These satellites are 22000km above the earth surface and completes one every 12 hours rotation around the earth. These satellites rotate in 6 orbits. Each orbit would be having 4 satellites so all the 6 orbits would be 24 satellites in total.

These 6 orbits would be inclined at 55 degrees with the equator and inclined in 60 degrees with each other. These satellites will be present in specific locations in each orbit.

The first two satellites will be in 30 degrees with each other. The second and the third are inclined in 105 degrees. The third and the fourth satellites are inclined in 120 degree and the last two satellites in 105 degree with each other.

This orientation would cover 360 degrees. It is required that a minimum of 4 satellites are to be accessible to the GPS device to get positioning services. This exact orientation would keep more than 4 satellites visible to a GPS device anywhere on the earth at any point of time.

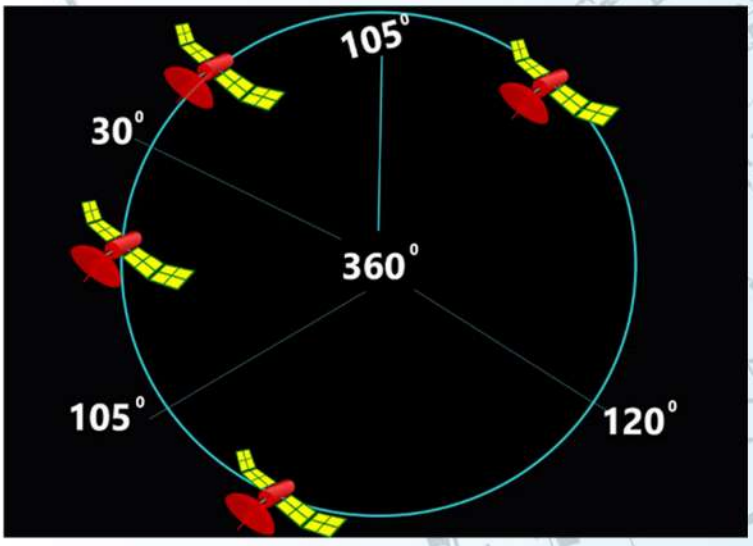
Ground Control Segment:

Ground Control System would be having 3 major parts in it,

Master Control Station: Master Control Station would be monitoring the health and the orbital path of the satellites in the GPS Constellation. It also updates the variation in the atomic clock in the satellite system. This is something which commands and keeps the control of the satellites in the constellation.

Monitoring Station: This tracks the signals from the satellites and informs the Master Control station, the effect of ionization in ionosphere and climatic changes on the signal health.

Ground Antenna: Ground Antenna supplies communication from the Master control station to the satellites in the GPS constellation.



User Segment:

Space segment and the Ground control segment work simultaneously to decide precise location on the earth. This location services are used by the devices in user segment. The main component of the user segment is the 'GPS receiver.'

Communication between Satellite and Receiver:

This GPS receiver contains the Receiving Antenna, a Processor, and a Clock. Manufacturers have made compact GPS components which made this GPS tracking possible even in mobile phones.

Satellites in the GPS constellation would transmit the information in Signals which are 'modulated' with Carrier Waves. These Signals are sent over two different bands of frequencies. These bands are

- The L1 band
- The L2 band

L1 band:

The information sent on the L1 band contains the following data,

- Course Acquisition Code: The Course Acquisition Code contains the PRN (Pseudo Random Number). This Pseudo Random Number is transmitted by the satellite and received later. This would be helpful in calculating the time of travel. The received signal is compared with the original signal with a process called correlation and exact timing is determined which gives the distance with precision. This PRN would be of 1023 bits length.

- Precision Code: Precision code would be specifying the precision of the location. It is possible to detect the location with 3 feet precision. This precision code would be accessible to military services in a raw way and to common public thorough encrypted algorithms.

- Navigation Message: Navigation Message contains the exact time and date when the carrier wave is sent along with Ephemeris and Almanac data. Ephemeris gives the orbit, and the position of the transmitting satellite and Almanac contains the status and health of all the satellites in constellation.

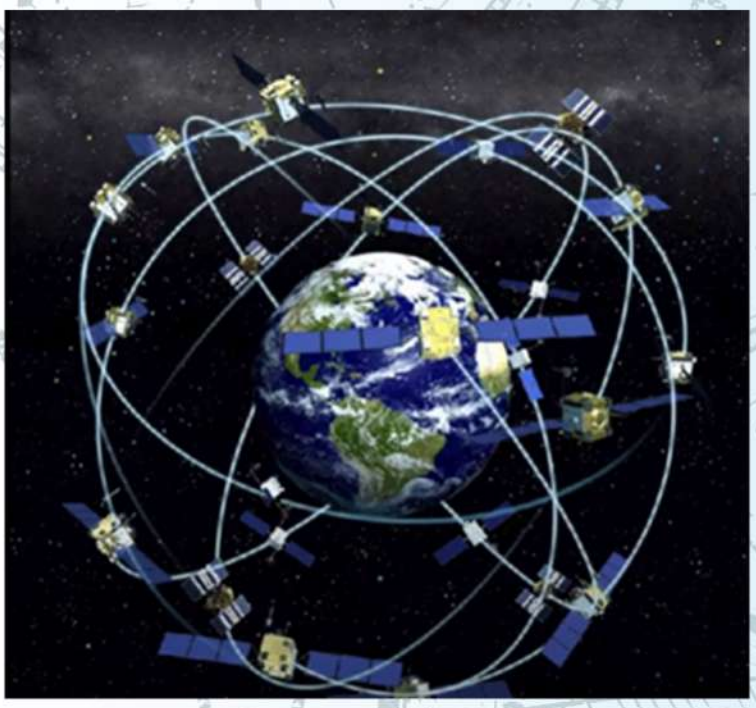
L2 Band contains only navigation message and precision code and is available to military services only.

Positioning:

Positioning or finding the location would is carried out through two processes called as Triangulation and Trilateration. Trilateration is used for distance measuring and navigation while Triangulation is used for studying earth layers and natural disaster prediction.

Trilateration:

Trilateration technique is based on trigonometry and geometry which helps in distance measuring and positioning. There are yet two classifications of trilateration which are 2D Trilateration and 3D Trilateration. 2D Trilateration provides positioning on a 2D basis i. e., latitude and longitude. 3D Trilateration provides latitude, longitude, and altitude information. 3D Trilateration is widely used since 2D Trilateration would not provide precise information of the location.



3D Trilateration:

To achieve 3D Trilateration, there need to be 3 satellites in communication with the GPS device. These 3 satellites would send signals of L1 Band frequency to the receiver device in order to know the receiver distance from the satellite. To know the time of travel between the transmission and reception, the time in the clocks of receiver and the satellite are compared.

GPS receiver will be having a Quartz clock which has a lot low precision then the atomic clock used in the satellites. Here comes the requirement of the 4th satellite. This would be synchronizing the time in its atomic clock to that of the receiver to know the exact distance.

The Signals transmitted by the satellite are electromagnetic radio waves which would travel with speed of light. As we will be having the speed with which the wave has travelled and the time of travel, we can find the distance of travel. Now, each satellite will be having its distance from the receiver. Each of the satellite draws a sphere with the radius as the distance. The intersection of these 3 spheres would result us in 2 points (Intersection of two spheres would give a circle, and intersection of 3 spheres would result in 2 points). From these two points the exact location could be known considering the surface of the earth as the 4th sphere.

So, the intersection of 4 spheres would give us a 3D coordinate of latitude, longitude, and altitude hence the position is finally found.

Atomic Clock in Satellite:

The atomic clock inside the satellite is influenced by Einstein Theory of General Relativity and Special Relativity.

Special Relativity in simple terms says that speed manipulates time. As the GPS satellites in the constellation rotate at speeds ten times higher than the rotation speed of earth, the atomic clocks in satellites are 7 microseconds slower than the atomic clocks on the earth.

General Relativity in simple terms says that Gravity manipulated time. As the GPS satellites are 22000km above the surface of the earth, they would experience very less gravitational force of attraction and hence time in the atomic clock moves faster than the atomic clocks on the earth. So, the atomic clock in the satellite would be 45 microseconds faster than the atomic clocks on the earth surface.

Now combining the above two scenarios, it can be understood that effectively, the atomic clock in a satellite would be 38 microseconds faster than atomic clock on earth. This 38 microseconds error is synchronized by the Master Control Station with the help of Ground Antennas to mitigate navigation errors due to this time difference.

- SVS SIDDARTHA
1602-18-735-118

ASTRAL PROJECTION

Those of us who saw the movie Insidious or Doctor Strange would have a fairly good idea about what Astral Projection [AP] or Astral travel means. In the movie "Insidious", the kid's soul leaves the body and roams around whilst he is asleep. He hovers around his room and stares at his sleeping self. Creepy right? And in the movie "Doctor Strange" among the titular superhero's powers (as the "Master of the Mystic Arts") is astral projection. That briefly describes Astra Projection which means the ability to separate his physical body from his spiritual one. On the screen, this is all enhanced by cutting-edge computer-generated effects.

Astral projection is fun and fascinating — but is it real?

View of sage

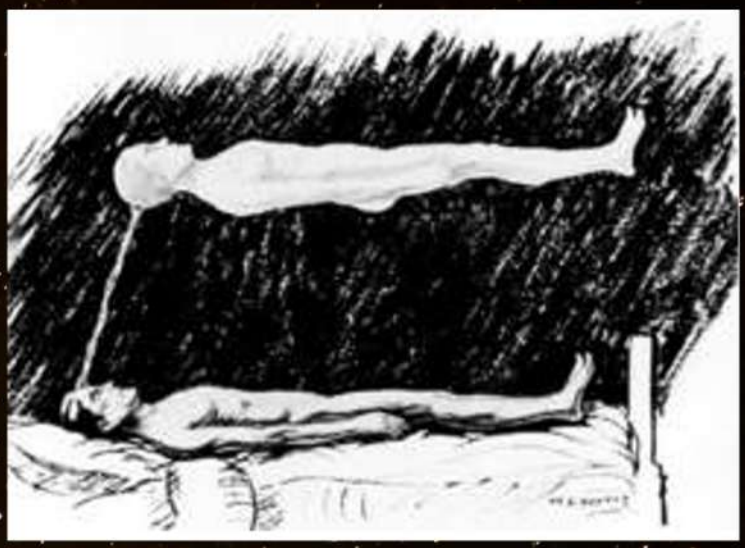
The human body has 5 dimensions namely the physical body, mental body, energy body, bliss body, and etheric body. Talking in technical terms physical body is like hardware and the mental body is like software. mental body is like software. Your hardware and software are no good unless you plug it into quality power which here is the energy body. The first 3 layers are physical in nature. The fifth layer, the bliss body is completely non-physical and the fourth layer the etheric body is transitory. The meaning of the astral body is that leaving the physical, mental, energy, and bliss bodies intact and allowing the etheric body to float around. Which is one kind of mastery.

The idea that humans can leave their bodies during dream states is ancient. Countless people, from New Agers to shamans around the world, believe that it is possible to commune with cosmic intelligence through visions and vivid dreams experienced during astral projection, also known as out-of-body experiences. Surveys suggest that between 8 and 20 percent of people claim to have had something like an out-of-body experience at some point in their lives — a sensation of the consciousness, spirit, or "astral body" leaving the physical body. While most experiences occur during sleep or under hypnosis, some people claim to do it while merely relaxing.

A doctor or a scientist's point of view

Seems to be that all of us can be placed somewhere along a sliding scale, based on how unstable or erratic our temporal lobe is, and some people are more prone to these experiences," said study researcher Dr. Jason Braithwaite. Some new researches have been done by doctors, they say that these experiences can be caused by physical or mental illness. And most of the time they are because of the instabilities in a part of the brain named the temporal

lobe. This temporal lobe is largely respons-ible for creating and reserving both conscious and long-term memory. The temporal lobe interprets the sensory and other information coming in from the body and places it on a body map, giving us our sense of being inside our body, of looking out from our eyes. If this interpretation goes wrong, a hallucination can occur in which a person sees themselves from outside of their body, also called an out-of-body experience (OBE). Doctors even conducted various tests on people who claimed to have such an experience with the help of specific questions and some computer-based tasks which to an extent proves that this type of out-of-the-body experience is merely a medical problem.



Some reallife experiences

A woman called Erin Pavlina was reported to have such an experience where she sensed 3 other entities in her bedroom trying to coax her out of her body. She had difficulty in breathing and to free herself from the paralysis state she was in. The more she fought it the more terrified she became, and she woke up eventually feeling restless and disturbed.

The U.S air force has also had an out-of-body experience. As planes got faster over the years the pilots started flying themselves into GILOC (gravity-induced loss of consciousness) and they kept crashing. Then a person named James Whinnery came up with a solution of spinning around like a centrifuge in the GILOC. And as he started spinning them in GILOC, the longer he spun them people started reporting the out-of-body experience.

Another case from Pim Van Lommel's study in which a patient who died on the operation table was brought back to life that is that he had a near-death experience. And when he died his glasses were removed by the nurse and kept in a drawer. Later when everyone was looking for the glasses everywhere, then the patient answers, "it is in the bottom drawer over there

There have been several incidents where people have come forward to narrate such type of experiences they have had.

But to date, no solid evidence has been obtained that proves that AP is a reality and not a fantasy. Even though sever al people have reported such experiences, sci entifically we haven't got some concrete 'YES' to the existence of such a phenomenon. They have tried to recreate or verify such experiences but failed consistently.I believe that ever ything cannot be explained scientifically with our current knowledge on world and ourselves.

_conclusion

I mean there are many things that no one can prove. Maybe this is one of them, maybe Astral travel isreal, maybe people can see themselves from a bird's eye view if they practice meditation. Or it just is a mental illness and can be cured by meds. What do you think guys? Is it real or not?

- Richika Reddy
1602-19-735-054

ANIMATION TECHNOLOGY IN ANIME

"Arigato", "Soka", "Sepal", "Gomenasai", "Sugoi". If you are wondering whether what these words are or might just probably be thinking that I have gone nuts, then just hold back fellas!!! These are some of the Anime phrases which you'll hear in most of the Anime series. Now let me take you through the journey of anime and feed your brains with how technology of animation has made an impact on present day Anime.

Anata no sh□toberuto o shime -- (Fasten your seatbelts) .....

Shiawasena tabi -- (Happy journey) .....

History of anime

The history of anime can be traced back to the start of the 20th century, with the earliest verifiable films dating from 1906.Before the advent of film, Japan already had a rich tradition of entertainment with colorful painted figures moving across the projection screen in 写□絵□□ (Ut sushi-e), a particular Japanese type of magic lantern show popular in the 19th century.

TYPES OF ANIMATIONS

There are 5 types of animations

Celluloid Animation:

This involves drawing various images that are slightly different and then tracing them onto transparent sheets called a cel.

2D OR TWO-DIMENSIONAL ANIMATION:

This type of animation is done using sketches or 2d flash software. It may be very useful for interactive 2d presentation, 2d cartoons or any movie. 2d Animation is not much attractive but it is cost efficient and quick to make.

Some of the biggest anime hits are: Dragon ball Z, Naruto, One Piece, Attack On Titan.

3D ANIMATION:

3d Animation is very popular and is used by every advertisement and movies. This is also used on a large scale for project presentation and pre-visualization. 3d Animation gives attractive quality and is costly. It is generally a time taking process. Movies like Toy Story, Avatar, and Moana have all solidified 3D animation as the go-to style for creatives.

3D animation is the manipulation of three-dimensional objects and virtual environments with the use of a computer program.

1. Animators first create a 3D polygon mesh with various connected vertices to give it form.
2. The mesh is then rigged by giving it an armature, a skeletal structure that can be manipulated to make the object appear in specific poses.
3. After making other objects and environments, the artist then uses the software to create scenes that are

This form, which is also called computer-generated imagery (CGI),

Stop motion

This technique involves setting an object or character in a specific pose against a background and taking a picture.

Motion Graphics

This visual effect technique involves moving graphic elements such as text or logos, mostly using software such as After Effects.

Popular Animation techniques:

Clay motion-> This is a form of stop-motion that is popular enough to be seen as its own technique. This involves the same process, but clay (plasticine) is used for almost all the characters, objects, and backdrops.

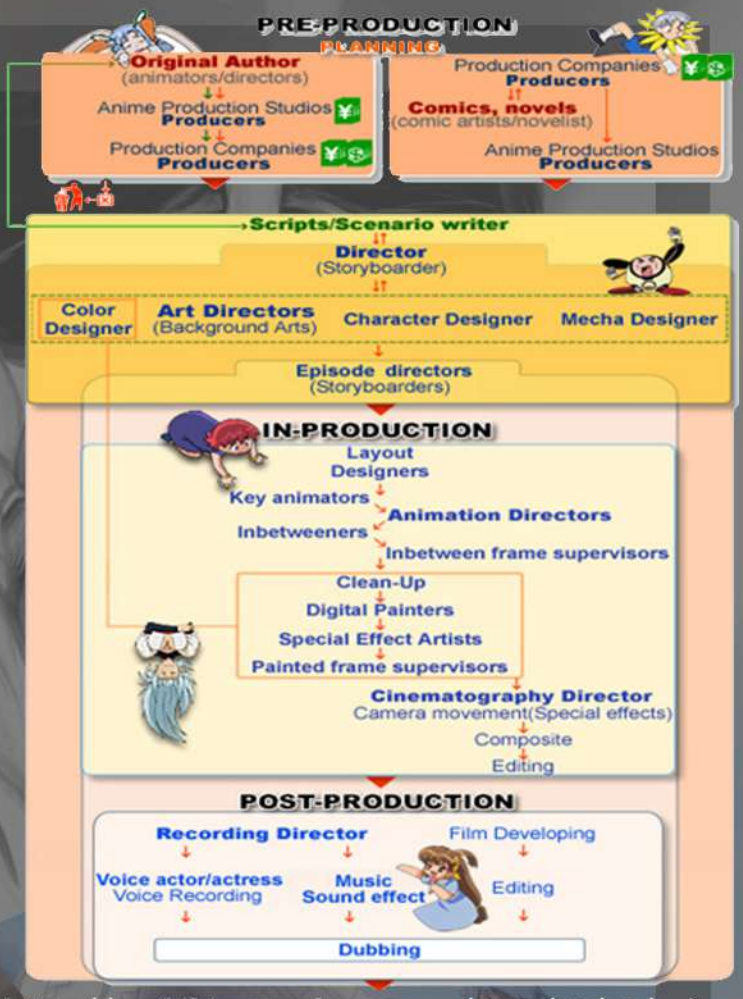
Paint on glass animation-> This rare but attractive technique requires the manipulation of slow-drying oil paints on sheets of glass to create the illusion of motion. Even though it is uncommon and difficult to do, paint-on-glass animation is usually well received. A Russian animator by the name of Aleksandar Petrov has used this technique to create seven films, and all of them been award winners.

ANALYSIS OF TIME TAKEN TO DO ANIMATED MOVIE:

For a full-feature animated movie it can take years. It takes roughly 6weeks to complete 60-90 seconds of film. For a short movie it could take 6 months. Also depends on your type of animation; Stop motion takes 7 years; hand-drawn takes 5 years; digital-cell 2d animation takes 3 years, and 3d animation takes 3 years for full-feature.

HOW IS ANIME MADE?

The process of making an anime is a complex one, with many steps and stages. This chart from AIC's English website is a good visual overview for what I'll be discussing:



https://washiblog.wordpress.com/2011/01/18/anime-production-detailed-guide-to-how-anime-is-made-and-the-talent-behind-it/

Want some fun with animation? Want to try making anime characters from ur finger tips charat.me here u can create anime characters.
www.mixamo.com here you can find some motion animation stuff easy and free.

6 best animation software:

1. Adobe animate
2. Autodesk 3ds max
3. Maya
4. Dp animator maker
5. toons
6. moho

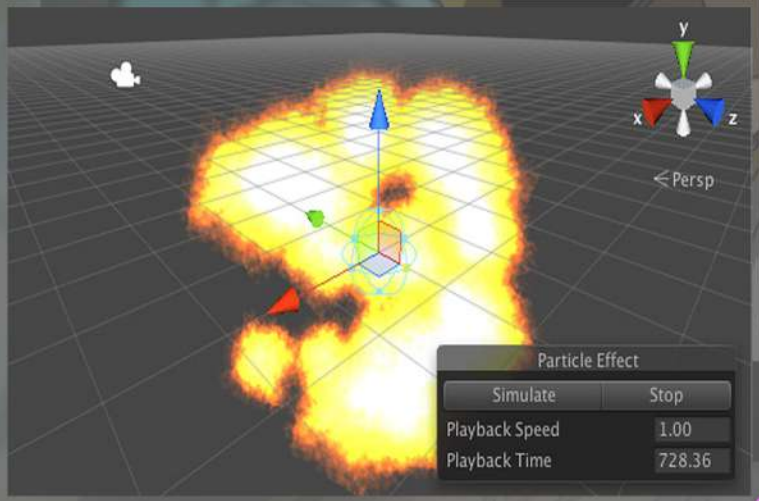
To learn more about these: https://windowsreport.com/animation-software-anime/

Creating an explosion in unity3d:

A simple explosion produces a ball of flame that expands outward rapidly in all directions. The initial burst has a lot of energy and is therefore very hot (i.e., bright) and moves very fast. This energy quickly dissipates which results in the expansion of flame slowing down and also cooling down (i.e., getting less bright). Finally, as all the fuel is burned up, the flames will die away and soon disappear completely.

An explosion particle will typically have a short lifetime and you can vary several different properties over that lifetime to simulate the effect. The particle will start off moving very fast but then its speed should reduce greatly as it moves away from the center of the explosion. Also, the color should start off bright but then darken and eventually fade to transparency. Finally, reducing the particle's size over its lifetime will give the effect of the flames dispersing as the fuel is use up.

```
void Explode() {
      ParticleSystem exp =
GetComponent<ParticleSystem>();
      exp.Play();
      Destroy(gameObject, exp.main.duration);
   }public float fuseTime;
   void Start() {
      Invoke("Explode", fuseTime);
   }
   // Grenade explodes on impact.
   void OnCollisionEnter(Collision coll) {
      Explode();
   }
```



Deeplearning in animation:

Generative Adversarial Networks (GAN) are a class of neural networks that aim to learn to generate objects from a certain class. Previously, GANs had been mostly used to generate images: human faces, photos of birds and flowers as in StackGAN, or, somewhat surprisingly, bedroom interiors, a very popular choice for GAN papers due to a commonly used part of the standard LSUN scene understanding dataset.

Researchers from the University of Illinois and the Allen Institute for Artificial Intelligence have developed an AI model, called CRAFT (Composition, Retrieval, and Fusion Network), that takes text descriptions (or captions) from the user and generates scenes from 'The Flintstones' cartoon series. If this model succeeds then your favorite novel can be converted to anime with machine. If you want to know more. Go here https://medium.com/neuromation-blog/neuronuggets-deep-anime-13fb47882d23

- K. Chakradhar
1602-18-735-069

THE APPLE'S TALE

Yes, it is the "doctor" repellent apple that caught my attention. Did you ever wonder about how an apple provoked a genius and marked the inception of one of the remarkable theories of physics? Well then, that is what this article is going to take you through. The mythologies believe that it was the forbidden apple that led humanityto encounter the consequences of greed, prominently by taking a bite out of the apple, known as "Adam's Apple".

It is one of the most famous anecdotes in the history of science. The young Isaac Newton is sitting in his garden when an apple falls on his head, the law of gravitation emergedwith this little aesthetic fruit.

Also, imagine the seeded part of an apple to be a bar magnet, then the exocarp(outer skin) resembles the continuous magnetic lines. The world's biggest tech company has a bitten apple as its logo,where bite in English, represents the bits and bytes to where are computers calculated

Apple holds a great symbological significance in several mythologies across the globe. Dan Brown's masterpiece "The Da Vinci Code" provides us insights about this.

Perhaps this little fruit has magical powers or this could all be a serendipity. However, this analogy has interesting secrets that remain oblivious to all of us.

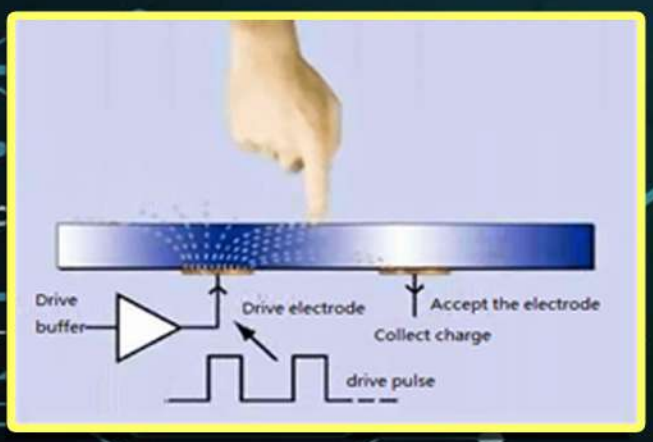
- Pradyumna HK
1602-19-735-132

ELECTRONICS INSIDE YOUR SMART PHONE

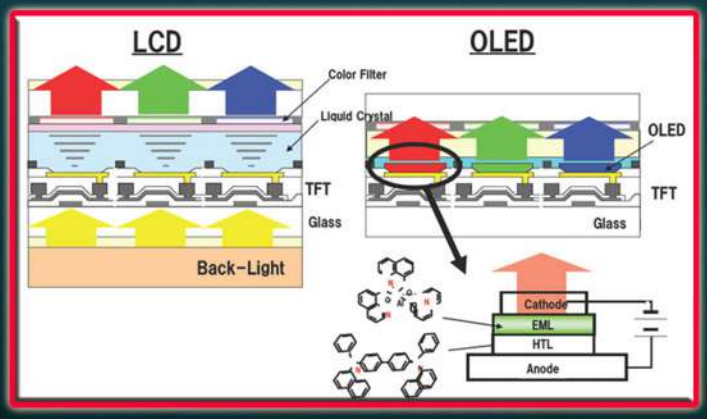
Smart phone has become one of the basic needs of every human being besides food, water and clothing. It has gained huge significance due to the emerging technical challenges and evolution of digitalization. Did you ever wonder what makes a smart phone so powerful? Are you curious to know what is inside a smart phone? Well, then this article is for you. You can explore all the electronics, which makes impossible to be possible, embedded inside the smart phone. So, let's start our journey to the interior of the smart phone.

Display

The very first stop in this voyage is screen. How does your touch screen work? Touch screens are generally Cpacitive screens that work with anything that holds an electric charge. Interesting, right?
Our human skin holds an electric charge and therefore your touch screen doesn't respond when you wear gloves. These are constructed from copper and holds charges in an electrostatic grid of wires. When you hit the screen, a tiny charge is transfered to your finger creating a voltage drop at that point. The position of voltage dorp is processed by the software to perform the requested action.



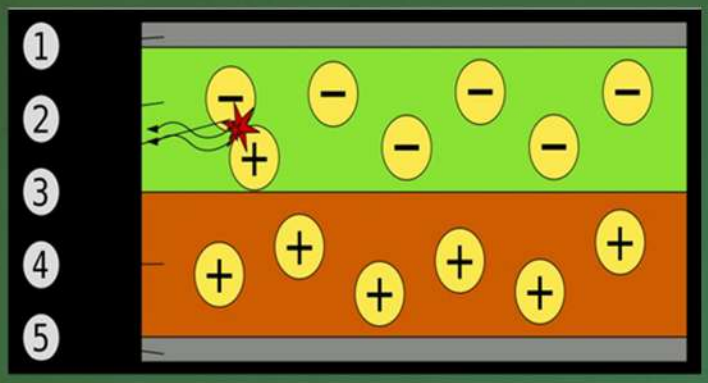
Whenever we talk about display, the first word that comes to our mind is resolution. What is this resolution? Why the display is not similar for all the phones? It is the number of pixels on display or in a camera sensor. The size of the display will determine how many pixels are crammed into a square inch, giving us the pixel density referred to as ppi. Phones with different pixels have different clarity.
What is HD? We all know it is high definition but what does that mean? It is a pixel measurement of 1280x720 pixels. No matter the size of screen, number of pixels remain the same. So, simply having HD display doesn't matter much. Full HD is the next step and it has 1920x1080 pixels and 2K(QHD) is available on high end devices. QHD is Quad HD and provides 4 times higher resolution than HD. Many phones from Samsung, Motorola, Huawei include 2K displays. 4K displays are also present in the market but 2K displays have become the norm at the top of the market rather than high 4K resolution as they demand more power.



LCD and OLED displays are most common which displays image from the processor's GPU. So how does this LCD work? Liquid crystal display refers to the array of liquid crystals illuminated by the back light. They work good in direct sunlight but the drawback is that they are less potent than displays that don't require a backlight.

Thin Film Transistor (TFT) is advanced version of LCD where every pixel is attached to a transistor and a cpacitor called as **Active matrix.** Their disadvantage is they require more power, less impressive viewing angles and colour production and hence they are not used anymore. **In-Plane Switching (IPS)** overcomes disadvantages of TFT by using two transistors for each pixel. This also eliminates backlight leakage.

Active Matrix Organic Light Emitting Diode (AMOLED) or OLED is another thin film technology.They have much purer blacks and consume less energy when black or darker colors are displayed on screen. LCD's are back lit whereas these are in off state unless they are specifically electrified. The downside is they are not visible in direct sunlight as LCD. OLED displays are commonly referred as AMOLED when used in smart phones. Like IPS LCD, Super AMOLED have extra features such as integration of touch screen into display itself

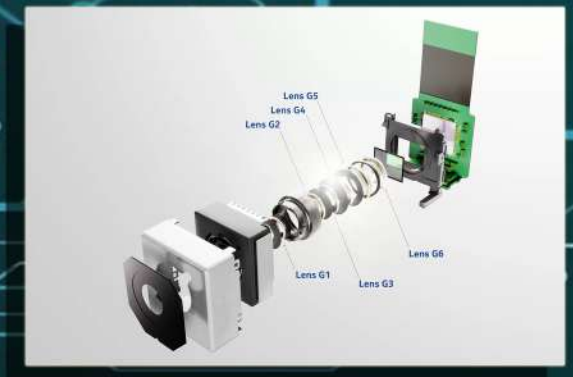


Schematic of a bilayer OLED:

1. Cathode (-)
2. Emissive Layer
3. Emission of Radiation
4. Conductive Layer
5. Anode (+)

Camera

Now, let us understand how your camera clicks beautiful pictures. When taking photos of an object, your camera phone will capture the light coming from it. A convex lens is used in the camera to focus incoming light onto a CMOS sensor. The sensor will then digitise the light and will turn it into a JPEG photo that's then saved on your smartphone. They have adjustable focus on the rear-facing camera. The lens can be moved back and forth to vary the distance between the lens and the sensor. But what makes your photo blur?

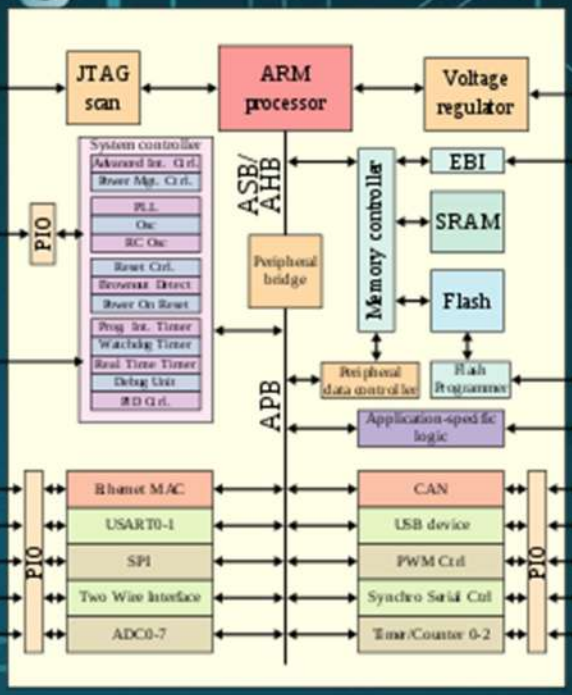


E-shutter is the camera part before the sensor and the shutter speed is adjusted in low light. If it is low, the picture will be blur when you shake you phone while clicking it. If the light hitting the sensor is low, it has to apply gain to get a bright image and eventually tiny variations in pixel readings will make noise more visible. **Megapixels** refer to the number of pixels on the camera sensor. The more megapixels there are, more clear the image will be.

System on chip

What will process your instructions in a Smart Phone?

Smartphones have SOC's as CPU in a computer.



SoC, System on Chip application processor. It is a CMOS chip, typically complementry metal oxide semiconductor. A typical smartphone contains a number of metal oxide semiconductor (MOS) integrated circuits, which in turn contain large number of MOSFETS.

Combining multiple components into a single chip saves on space, cost, and power consumption. SoCs connect to other components too, such as cameras, a display, RAM, flash storage, and much more. cEssentially, an SoC is the brain of your smartphone that handles everything from the Android operating system to detecting when you press the power off button. They became popular due to their low power consumption.

The following components are present inside the SOC:

- Central processing unit (CPU)
- Graphics Processing unit (GPU)
- Image Processing unit (ISP)
- Digital signal Processor(DSP)
- Neural Processing Unit (NPU)
- Video Encoder/Decoder
- Modem

With 5G networks whirring across the globe,we have SoC's integrated with high end modems.

Memory

An SoC can't function without Random Access Memory (RAM) or permanent storage. The practical minimum amount of RAM for a 64-bit Android 7.0 smartphone is 2GB.Flash memory is an electronic, non-volatile computer memory storage medium that can be electrically erased and reprogrammed. When you use an app, your phone keeps the app and what you are doing in RAM even if you switch to another app. When you return to it, it opens exactly where you have left. This is because it is stored in RAM and it runs in background even while using other app. This is called Multitasking

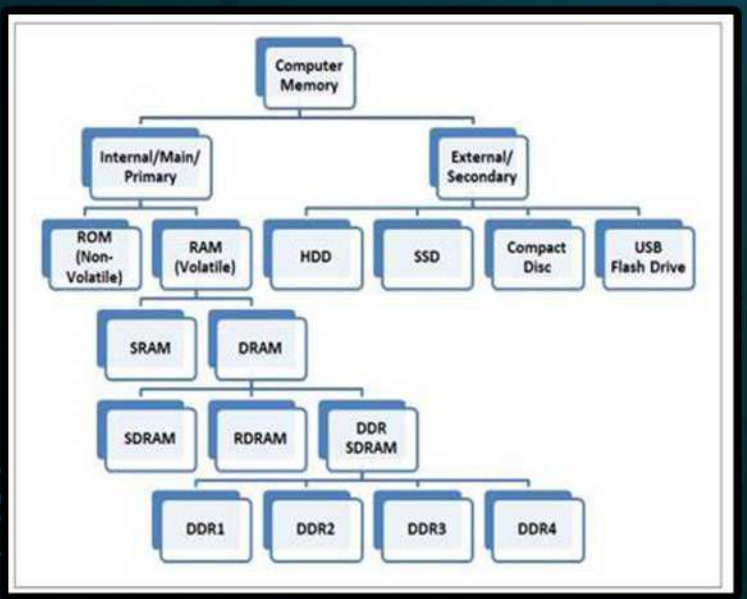
Then what is Internal and External memory?

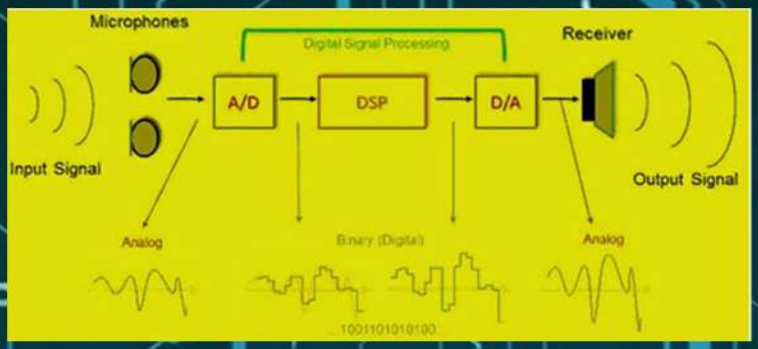
Internal memory is the manufacturer-installed storage space usually 16 GB,32 GB and 64 GB where operating system, pre-installed apps and system software is installed. Total amount of internal memory cannot be changed by the user.

Inside a 2 GB SD card: two NAND flash chips (top and middle), SD controller chip (bottom)

External memory is something that is extendable, it refers to a microSD card that can be inserted in the slot present in the phone.

To overcome the internal storage problem, many smart phones came up with a cloud storage solution. The user is provided with a cloud storage account of 10, 20 or 50GB storage but your data can be accessed if you have wifi or mobile data. The other form of external storage is cloud storage such as GOOGLE Cloud and DROPBOX.





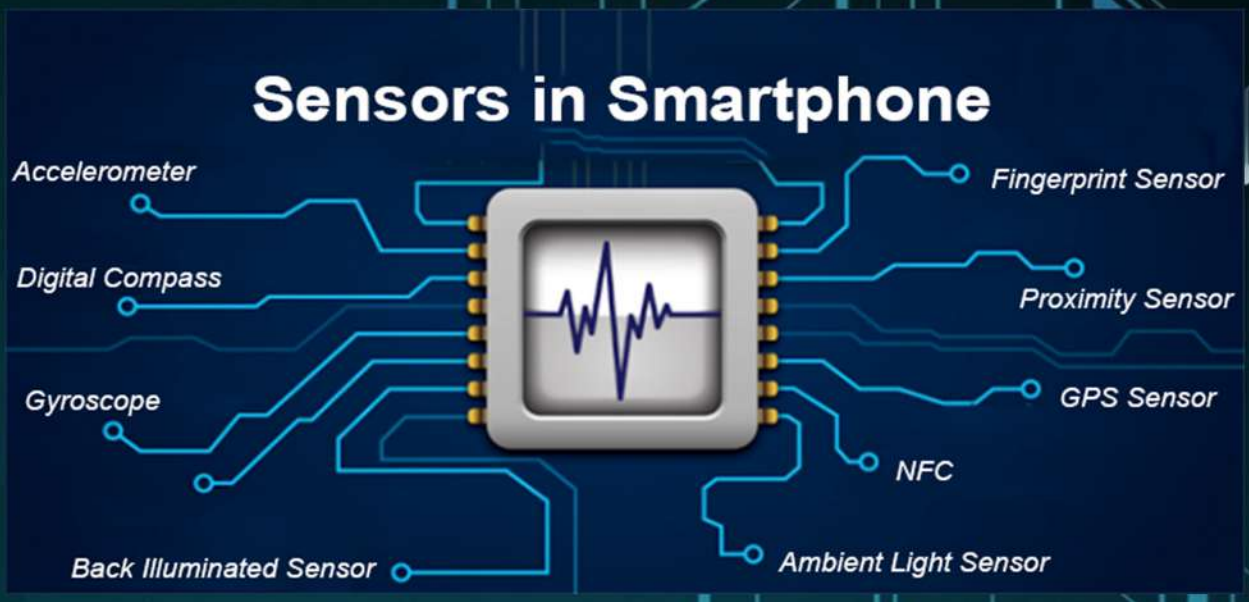
Audio Signal Processing

What makes your phone also act as a sound system? A sound chip is an integrated circuit designed to produce analog signals. They are fabricated on MOS mixed signal chips that process analog and digital signals. These chips contain various oscillators, amplifiers, filters etc to enhance the audio quality. Digital Signal Processor (DSP) is used to enhance audio, also used now for image enhancement, augmented reality and video processing. But how can you hear the analog audio from your phone? We humans always enjoy the analog form of sound, which is in the form of a wave having peaks but it can't be stored in the smartphone in same way. This is because the world inside the smart phone is completely digital. A Digital to Analog Converter (DAC) is used to convert the digital audio signals stored in your phone to Analog signals. This process is not simple and it involves large number of calculations. The acquired analog signals are passed into an amplifier where the strength of the signal is enhanced. All phones have them for system sounds and voice calls. Most of the headphones even have a DAC and AMP.

RF CMOS

What makes you communicate with your friend on other side of the world? How can you browse your favourite websites through phone?

It is possible only with the RF CMOS chip. It integrates radio frequency (RF), analog and digital electronics on a mixed signal CMOS RF circuit chip. It is used in Bluetooth, Wi-Fi, GPS receivers, broadcasting. A typical smart phone features many antenna elements and multiple radio streams to ensure high data rate wireless communications, whether through cellular or mobile connectivity networks and peripheral devices. Multiple RF components are available to amplify, filter, and switch the required RF signals.

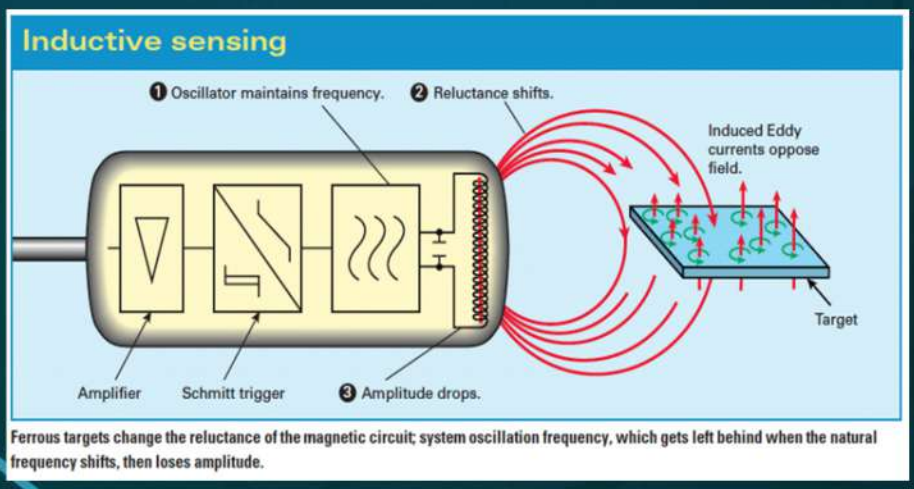


Light Sensor

How does your smartphone adjust the brightness level?
It is achieved with the help of ambient light sensor. It sets the screen brightness based on the surrounding light and helps conserve battery life. It is build using photo diodes and phototransistors.

Proximity Sensor

Did you ever notice your device locks the screen during a call when it is brought near your ear?
This is made possible by the proximity sensor. It emits an electromagnetic radiation and looks for changes in field or return signal.



Ferrous targets change the reluctance of the magnetic circuit; system oscillation frequency, which gets left behind when the natural frequency shifts, then loses amplitude.

- Sri Krishna Kirthi Sattenapalli
1602-19-735-049

THE ART OF Persuasion -INSPIRED BY REAL LIFE SCENARIOS

Stories are among the most persuasive ways we can share an idea. When we tell a story, we open a 'loop' in someone's thought process. It's uncomfortable for people to have an open loop and they'll often listen (or read or watch) until the conclusion of the story, which is when the loop is closed.

Another option includes 'Pacing and Leading' where we start from the listener's point of understanding. By reviewing that place, we begin to 'pace' the person and their ideas. Our brains get on the same wavelength and frequency — literally. We're then able to lead the listener to a new understanding.

Here's a real life scenario of persuasion: An extract from a talk by Richard Greene

I (speaker) personally had a job (once upon a time) selling 'coupons' door-to-door. Essentially it was something like free oil changes or half-price pizzas. Needless to say, it was pretty low on the glamour scale.

I wouldn't wish that job on anyone, but part of me wishes I could try it again, now that I have spent years researching persuasion.

Most of the people that would answer the door would immediately have that "oh god, why did I answer the door?" look on their faces, and it was my job to turn that into a $25 sale.

(For the $25 you received discounts or free things worth much more than $25, which was the core of the pitch).

With those, and all persuasion scenarios, the key element to success was rapport i.e. — putting them at ease, making them feel comfortable, and putting them in a good, trusting mood.

When someone likes you and/or trusts you, their requirements for agreement become much simpler.

Interestingly though, rapport is not always created by doing nice things for people. Sometimes that makes you look weak instead. It's more about presenting yourself confidently.

However, $25 was more than most people are willing to pay for rapport alone.

It was also necessary to control the perception of the offer.

We would ask them how often they eat pizza or get their oil changed, and then do the math for them so they could see how much it was actually worth.

Or we would look for a real-life scenario that was likely to happen to them — like a kid's birthday party or a long drive for vacation — that would basically guarantee the value of the offer.

In other words, we made them "qualify" to buy.

On top of that, it was a one-time offer (because I would walk away if they said no), and I had a limited number of "coupons" to sell.

In some ways that was true (we did one neighbourhood per day), but in other ways it was purely perception.

We also put the coupons in their hands immediately, so they had to choose to give it back rather than choosing to take it.

99% of people were reluctant at first. 5-20% of people would buy, depending on how well I performed.

Best sales training I ever had.

Takeaway : Don't directly ask for something you want, it's really easy for the other person to say no. Instead, help them with something that is relevant to them It'll take you a bit more effort, but it'll be much more effective!

THE STEVE JOBS GUIDE TO PERSUADING PEOPLE AND GETTING WHAT YOU WANT

Steve Jobs launched two of the most valuable and creative companies in modern times with Apple and Pixar – but he didn't reach those heights by following the rules all the time.

Jobs faced many obstacles to get Apple and Pixar off the ground. But he had a unique way of crafting his own reality, a "distortion field" he'd use to persuade people that his personal beliefs were actually facts, which is how he pushed his companies forward.

He also used manipulative tactics to ensure his victories, particularly in boardroom meetings with some of the most powerful company executives in the world.

Many consider Jobs a genius, and everyone can learn a thing or two from his tactics.

Pitch with passion. People can be influenced by strong displays of emotion

Pitching was a key part of Steve jobs and it should be part of yours, too. The process of selling – yourself, or a product – is the key to getting others to buy into your ideas.

Before Apple launched iTunes in 2001, Jobs met with dozens of musicians in the hopes of corralling record labels into going along with the iTunes plan. One of the people Jobs pitched to was prominent trumpet player Wynton Marsalis.

Marsalis said Jobs talked for two hours straight.

"He was a man possessed," he said. "After a while, I started looking at him and not the computer, because I was so fascinated with his passion."

Jobs also pitched ideas to his ad team with a similar passion to "ensure that almost every ad they produced was filled with his emotion." The resulting commercials, like the "1984" ad and the iPod silhouette ads,helped Apple become much more than just a computer company.

CONCLUSION:

"Persuasion" is a term often used in marketing, and we're all probably aware of it. What many businesses fail to realize is that persuasion isn't just about getting people to buy your product. You may be able to get people to convert, but are they happy about the purchase? Were you able to change their sentiment towards your brand in a positive manner?

Persuasion in marketing involves the ability not just to influence people's actions, but their attitude as well.

- Syed Adil Fyjaan
1602-18-735-052

- Meghana
1602-19-735-086

Geospatial Cooperation Agreement (BECA)

Basic Exchange and Cooperation Agreement BECA will allow India to use US geospatial maps to get pinpoint military accuracy of automated hardware systems and weapons such as cruise and ballistic missiles. Along with Communications Compatibility and Security Agreement (COMCASA), and Logistics Exchange Memorandum of Agreement (LEMOA), BECA is one of the foundational military communication agreements between the

Geospatial Cooperation Agreement (BECA)

Recently, on October 27th 2020 India signed the fourth and final foundational military pact called the Basic Exchange and Cooperation Agreement for Geospatial Cooperation (BECA) with the US to strengthen the strategic ties between two countries.

What are the other foundational pacts between the two countries?

- ***General Security of Military Information Agreement (GSOMIA), 2002: This was made to withhold the privacy of the military particulars shared between the two countries.***

- ***Logistics Exchange Memorandum of Agreement (LEMOA), 2016: This pact establishes basic terms, conditions, and procedures for logistic support, supplies and services.***

- ***Communication Compatibility and Security Agreement (COMCASA), 2018: It allows India to procure specialized equipment for encrypted communications.***

All we need to know abot BECA:

- ***Firstly, geospatial means any data that is related to a geographical location. Geospatial technology collects and analyzes where particular features are on the Earth's surface; such as oceans and mountains.***

- ***This pact includes giving India access to accurate geospatial data that will have several military and other defense applications and help India in giving more accuracy to forces while using weapons like cruise, ballistic missiles and drones.***

- *It will make mission planning easier for the Indian forces, as they will be provided with the geographical coordinates and feeds in real time data which will considerably reduce the chances of missing the target.*

- *This will also make India a fearsome force in the Indian Ocean, where the Chinese have been sending several ships and submarines.*

- *India can now keep a close watch on the movement of ships and submarines in the Indian Ocean. India and US can exchange maps, nautical and aeronautical, commercial imagery, geophysical, geomagnetic and gravity data.*

- *The agreement will also allow the US to share sensitive satellite and sensor data that would help India in striking military targets with pinpoint accuracy.*

How is BECA related to Electronics and Communication?

- *The geospatial technology includes geo-data referencing framework and Timing accuracy via atomic clock.*

- *The complexity in precise Geo-tagging of a target begins with the Geo-reference plane problem caused due to Earth's shape being spheroid (or ellipsoid) and various other factors like Geo-corrections emanating from varying gravitational profile etc.*

- *Obtaining a precise and accurate location of a digital target track for warfare algorithms and mathematical computations to work is likely to be highly error-prone in case Geo referencing the framework is not well defined or regularly updated.*

- *A track reported by radars and a plethora of other sensors (sonar's, EW sensors etc.) fitted on a geographically disperse static or dynamic platforms makes this solution all the more inaccurate for a perfect weapon launch.*

- *Further, any lack of Real 'timeliness' of the signal information on the target can add to calculations being run on a 'stale' track, i.e. a weapon launch at a position where a target may have never existed or likely to be in the future.*

- *The weapons are launched at a future position for a dynamic target and in today's Net centric Warfare which is highly dependent on a Multi-platform Multi-sensor data Fusion (MPMSDF) engine, such errors can lead to serious consequences since the fast-moving hostile fighter jets or incoming missiles may not give a second opportunity to intercept them.*

Consequences India might face after signing BECA:

- *Dependence on Russia: India depends on Russia for 60-70% of its military equipment. As the rivalry between US and Russia is well known, US might want India to withdraw their relations with Russia.*

- *India saying no to alliances: Over the past few decades, it's been clear that India has no interest in forming alliances which was even agreed by The External Affairs Minister Jai Shankar in a press meet. But contrary to this US might want India to be a part of an alliance to form a stronger counter to China.*

- *Decision making liberty at risk: Many of Foreign Policy experts claim that these agreements would allow The US to enter into the decision-making structure of India which would rupture the decision-making independence of India. This is something which any sovereign country would not*

Therefore, we should look at various aspects of this Agreement and appreciate on the type of technology used and how precisely it is going to enhance the defense mechanisms making India an unbeatable force in terms of protecting its territory.

- M Achyutha Sai Shree
1602-19-735-002

HOPE

Our World was once bold and brave,
But now it has become lonely as a grave.

It is not about the stress in our brain,
But it is the silent heart pain.

Days, weeks and months have passed by in wait,
Still isolation is in our fate.

Virtuality is the only way to greet,
For people are far away to meet.

Being a human, I hope,
That there may still be a scope.

Nothing can sustain long,
We must always be strong.

- Anagha
1602-19-735-004

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