# Wall For All

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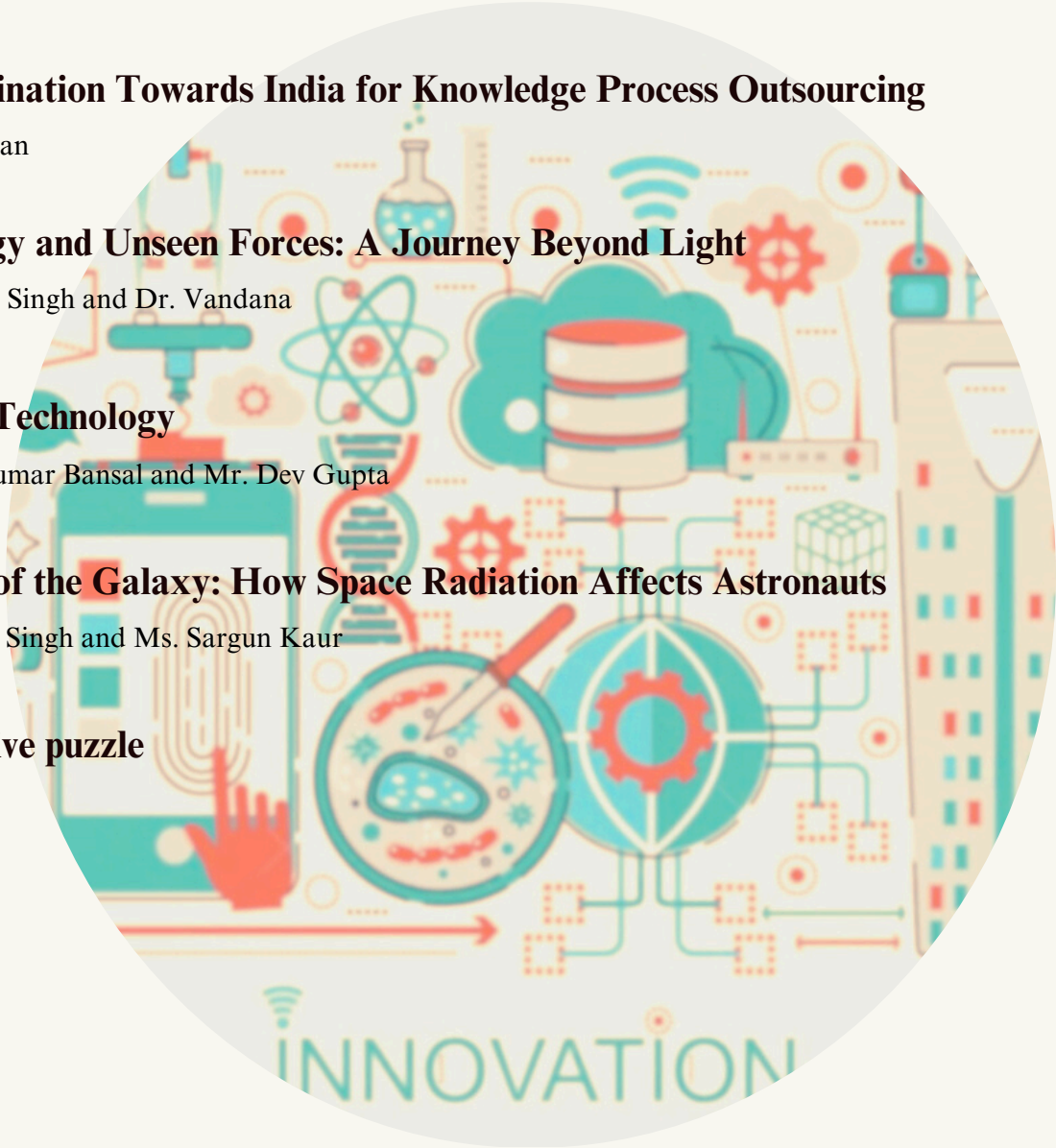
Chitkara University Institute of Engineering and Technology

Chitkara University, Punjab

# CONTENT





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## Dear Readers

The nostalgic feeling that one experiences while sifting through the dusty old pages of the college magazine cannot be expressed in words. However, very few of us have retained those copies, and most of those precious articles that we wrote during those golden days with enthusiasm are lost forever. With the advent of e-books and other online media, the days of paper-bound college magazines are gone, and the digital platform has paved way to allow retention of such publications without much effort.

*Wall-for-All*, the e-Magazine published by the Department of Computer Applications, is one such effort that was started with an intent to provide a chance to all students and faculty members to share their thoughts and knowledge, and hone
their skills in creative writing.

I am happy to see the enthusiasm of eminent members of the department to contribute to *Wall-for-All*. This shows the positive and creative energy of the contributors. However, it would be really wonderful if we can see the articles contributed by more students in the next editions, for this e- Magazine is intended to be a writing pad for each member of the department.

I proudly present the current edition of *Wall-for-All*.

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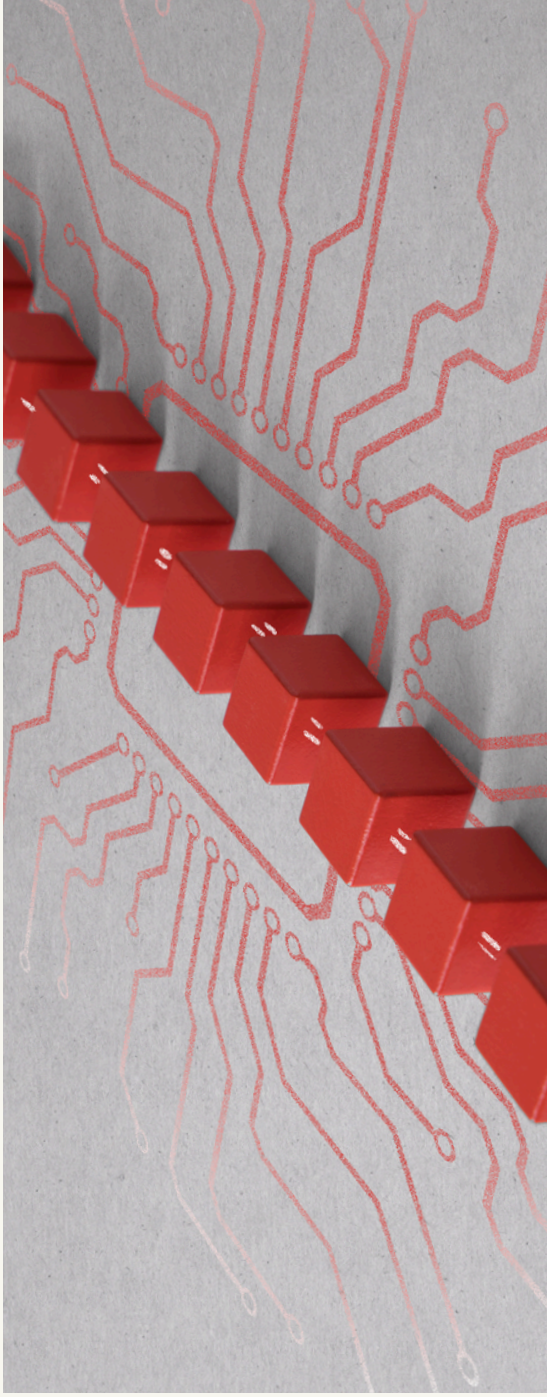
# BLOCKCHAIN: A MODERN DAY NEED



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Few technological advancements in the present era have sparked as much interest as blockchain. Since its origins in 2008 as the technology behind Bitcoin, blockchain has developed into a force that is profoundly disruptive and has repercussions for many other sectors. This article delves into the complexities of blockchain technology, examining its foundations, uses, obstacles, and potential.

**Understanding Blockchain: The Basics**

Fundamentally, blockchain is a distributed, decentralized ledger technology that makes it possible to record transactions over a network of computers in a safe and transparent manner [1]. Blockchain functions on a peer-to-peer network, where each participant (or node) retains a copy of the whole ledger, in contrast to traditional centralized systems where a single authority controls the ledger. Because the data is disseminated, no one party can control or own it, which promotes transparency and confidence among participants. The structure and security of data inside the system are referred to as "blockchain" techniques. Blocks are created from groupings of transactions, and these blocks are connected chronologically to form a chain [2].

A tamper-resistant record of transactions is created for every block by including a cryptographic hash of the preceding block. Because of its immutability, a transaction once registered on the blockchain cannot be changed or removed without the network's approval [3].

**Applications Across Industries**

Although blockchain technology became well-known in the financial industry mainly because of cryptocurrencies like Ethereum and Bitcoin, its applications go well beyond virtual money. Numerous sectors are investigating blockchain-based solutions to improve security, expedite workflows, and spur innovation [4]. Blockchain is transforming traditional banking and finance via enabling quicker and more secure cross-border payments, decreasing fraud and counterfeiting, and facilitating seamless trade finance and supply chain management.

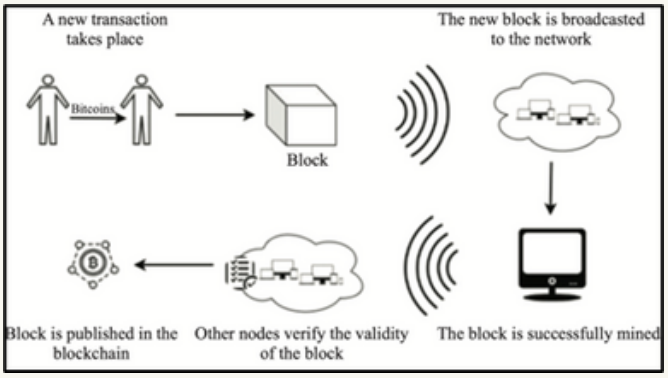


Figure 1: Workflow of blockchain [9]

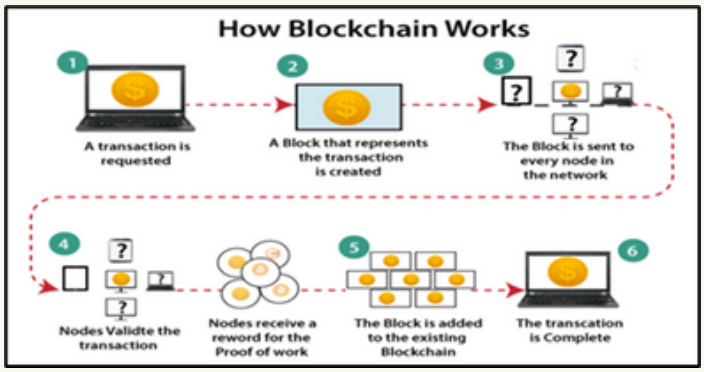


Figure 2: Blockchain Working [7]

This is in addition to modernizing cryptocurrencies. Blockchain technology has potential applications in the healthcare industry, including safe record storage and exchange, data integrity assurance, and improved system interoperability that would eventually improve patient care and privacy. Because of its openness and traceability, blockchain technology is perfect for supply chain management. It enables all parties involved to monitor the flow of goods from manufacturing to delivery, confirm authenticity, and reduce risks like fraud and counterfeiting. Blockchain technology is revolutionizing the real estate sector by streamlining transactions, cutting down on paperwork, decreasing fraud, and permitting tokenization and fractional ownership of properties. Governments are investigating blockchain technology for use in land registration, voting, public service delivery, digital identity management, and other areas, utilizing its security and openness to enhance governance and cut down on red tape [5].

**Challenges and Considerations**

Blockchain technology has many potential advantages, but it also has drawbacks and restrictions [6]. Among the crucial factors are:

Scalability is a problem for blockchain networks, especially for public blockchains like Ethereum and Bitcoin, which find it difficult to manage large transaction volumes and keep up network performance as they expand [7].

Authorities are having difficulty establishing clear frameworks for supervision and compliance in the complex and ever-evolving regulatory landscape around blockchain technology and cryptocurrencies. The lack of compatibility between various blockchain platforms and older systems continues to be a major obstacle to industry-wide collaboration and seamless integration. Although blockchain is praised for its security characteristics, there are serious concerns associated with flaws including smart contract problems, 51% assaults, and private key thefts that need to be handled with strong security measures and best practices [8].

**Future Outlook**

The future of blockchain technology is bright, despite these obstacles. We anticipate advances in privacy-enhancing technology, scalability solutions, interoperability protocols, and regulatory frameworks as research and development continue to progress. Furthermore, the increasing use of blockchain technology by businesses, governments, and individuals highlights its capacity to bring about significant social and financial changes in the future. To sum up, blockchain has the potential to completely transform the way we connect, exchange, and communicate in the digital age [9]. Through leveraging its decentralized, transparent, and unchangeable characteristics, we possess the chance to construct a more comprehensive,

safe, and effective worldwide framework that enables people and institutions in many fields.

We can realize the full promise of blockchain technology and usher in a new age of trust, transparency, and decentralized innovation by continuing our collaboration, ingenuity, and ethical stewardship [10].
The goal of the article is to give a thorough introduction to blockchain technology, including its foundations, uses, difficulties, and potential. Although blockchain technology is a broad and constantly developing topic, this article provides an overview of the revolutionary technology's potential for transformation.

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# Empirical Study on Apple iOS, Microsoft Windows and Google Android Mobile Operating Systems

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Nowadays, large population depends upon smart phones for performing all important tasks. Moreover, Life of ordinary people can't be predicted without mobile phones. Each smart phone has unique and different features that depend upon an operating system. Therefore, while purchasing the purchasing mobile phone the knowledge of operating system is mandatory. This empirical study mainly focuses on three popular OS of smart devices such as Microsoft based Window-phone, Apple iOS and Android phones and on the basis of features, comparison the advantages, architecture, market growth, and demerits of particular operating system can be identifies. This paper also emphasis the calculate security parameters provided by smart devices.

**Introduction**

In this current era, mobile phones are a fundamental part of modern life. A mobile phone is a wireless gadget that is used to full-duplex two-way radio telecommunication, or we can say which is used to make and receive phone calls. Mobile phones are also known as cellular phones, cell phones, headphones. The 'mobile' word has derived from the Latin Mobiles. Which means portable? These days mobiles are the common gadgets amongst the world. Mobile phones have changed so many Persons live across the world due to their many advantages [1].We can run all the services of a mobile phone because of an operating system. Every Mobile Phone needs an operating system to run different tasks for example phone calls, messenger, camera, etc. Earlier Mobile Phones were having very less functionality due to the very simple operating system. But nowadays, new smart phones have additional features in them for example:- virtual storage, High-resolution, megapixel cameras, High-speed CPU and GPU, Multipurpose communication hardware, Touch screen, Wi-Fi, GPS and so on [2].

**Mobile Operating Systems**

Mobile OS is a kind of software program that is working as a interaction better a end-user and software program for performing task efficiently. It aids to manage the hardware devices and enables features for the user to interact with the device. The mobile based operating systems are very popular such as Google Android, Apple iOS, and Microsoft Windows Phone. The ratios of share market for these OSs are Android 47.51%, iOS 41.97%, and Windows Phone OS 2.57%.[3]. Google Android is the most popular among these three OSs. Due to the following reasons:-

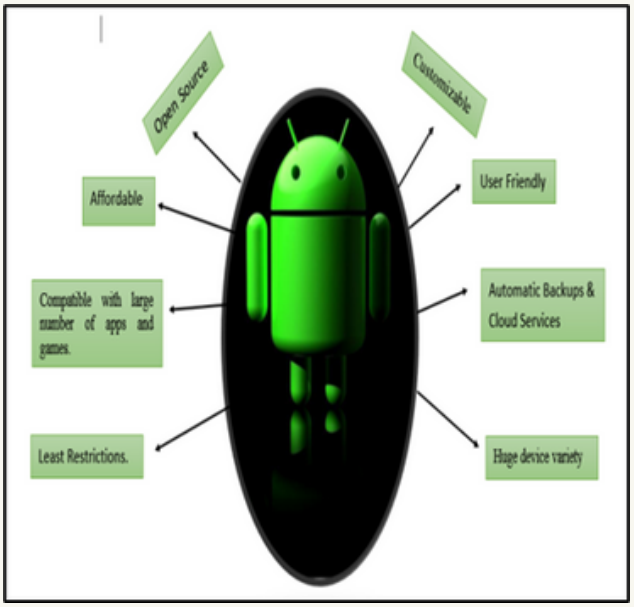


Figure 1: Popularity of Android[6]

Apple iOS is less famous as compared to Google Android due to the following reasons. Windows Phone is least famous among these three OSs due to the following reasons.

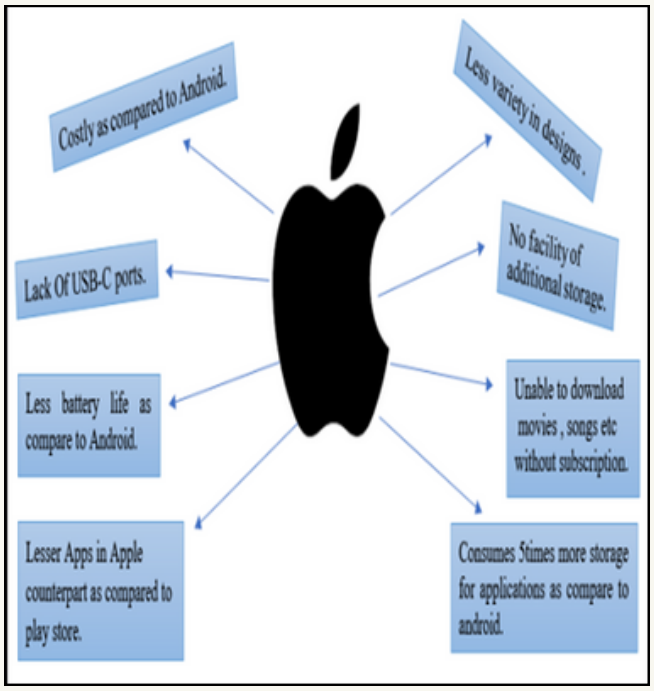


Figure 2: iPhone is Less Famous than Android [8]

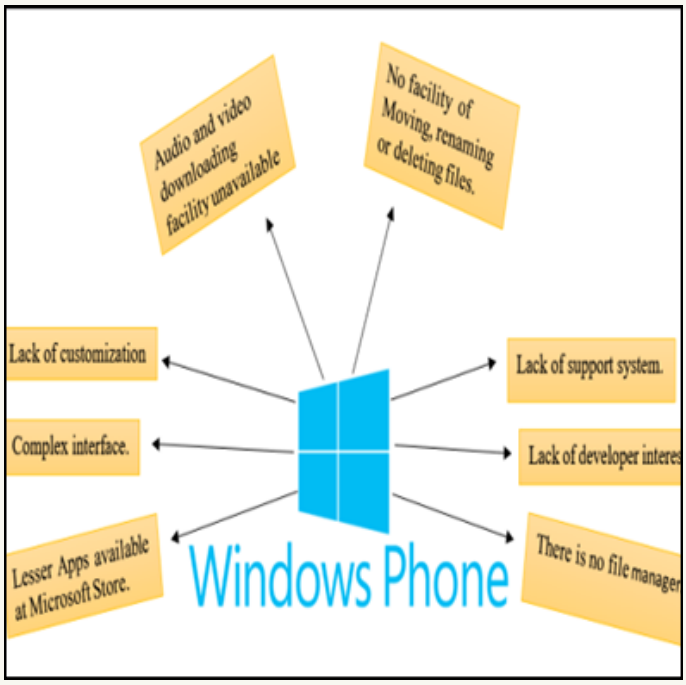


Figure 3: Windows Phone is the Least Famous[8]

These were the reasons behind the high and low share market percentage of these three particular operating systems. Now let us discuss the OSs of these three particular brands.

**Android Operating System**

The OS of Android is developed by Google, and it is based on LINUX Kernel. Android is so popular across the world because it is open-source and any developer can modify its code easily. The biggest advantage for android users is that they can download more than 1.5 billion applications through the play store. Android also provides an Android Software development kit (SDK) to developers, including libraries, documentation, a handset emulator, sample code, tutorials,& tools [5]. The code for android is written in JAVA(UI), C(core), C++, and others. Android OS is available in 100+ languages. The main feature of Google Android is Dalvik virtual machine (DVM). The role of DVM is to provide permissions to multiple virtual machines to run at the simultaneously, and used to optimized for low memory requirements [7].

**The architecture of Android OS**

Application Layer:- This layer is responsible to include SMS programs, Contacts, browsers, Email clients, and others.

Application Framework Layer:- The framework of APIs used by the Core applications and get access through this layer. All the components used by the developers get access through this layer.

Application Library:- It includes basic programming languages along with libraries that depend upon the various components of the Android. This layer also consists of system C libraries, SQLite, media library, etc.

Android Runtime:- This layer is combination of different libraries functions along with virtual machine. The Linux kernel is located at the bottom working like an abstraction between the software and hardware devices.

Linux Kernel:- It is the bottom layer and android depends on Linux operating system like process management, security management, and so on [9].

**iOS Operating System**

The OS of iOS is developed by Apple Inc. The code for this OS is written in programming languages like C and C++. It is built on Darwin core OS which is an open-source OS. iPhones are the world's second-largest installed mobile operating systems. More than forty iOS based languages are derived from Mac OS X by using main 4 abstraction layers.

Core OS:- It is the lowest level layer. This includes some basic features:- Security Services, Core Bluetooth Framework, Accelerate Framework, DNS, math, sound, and image processing.

Core Services:- This layer is subdivided into different frameworks and based on C and Objective-C[2]. It helps the OS to cure itself to give better results. It also includes basic applications services.

Media Layer:- This layer is responsible for using audio, video, and graphics (2D and 3D).

Cocoa Touch:- This layer acts as an interface between user and OS. The UIKIT provides functionalities like User Interface Management. It also supports touch and motion events.

**Windows Phone Operating System**

Windows phones are developed by Microsoft Corporation. The code for this OS is written in C, C++ programming languages. The current working state of this OS is discontinued. Windows OS is based on Windows CE kernel. In the sequential order, the versions of Windows Phone are:- Windows Phone 7, 7.5, 7.8, Windows 8 (GDR1, CDR2, GDR3), 8.1 (GDR1, CDR2), and Windows 10 (mobile) [12]. Figure below illustrates the basic Windows phone architecture.

**Literature Review**

T. Sharma et al.(2013) An analysis of mobile technologies and comparisons of mobile operating systems such as Windows Phone 7 OS, Blackberry OS, iOS, and Android OS is achieved by the Author in this review paper. The Author revealed that iOS and Android expanding rapidly in the market[1]. Puder et al. (2013) This paper represents the cross-compilation of android applications to other operating systems such as iOS and Windows 7 through Phone Gap, Mono Touch, and Adobe AIR frameworks. The researcher demonstrated that a cross-compilation framework is achievable[3]. Okediran et al. (2014) in this paper the author discuss various mobile operating system and their advance features as well as functions such as multi- tasking, multi processor and so on. This paper is also focus on the comparative technologies adopted by mobile devices [4].

Grønli et al. (2014) This research discusses the heterogeneity of mobile applications platforms. The researcher has categorized the various platforms such as platform capabilities, software architecture, application development, developer support, and constraints. The researcher also discussed that iOS and Android both have fully-fledged developed environments and communities [9]. Singh, R. Et al.(2014) this paper specifies the region of popularity behind android across the world and also discuss the pros and cons of android [5]. V. Rema et al.(2015) this paper aimed to know which OS is more famous in terms of users and focuses on demographics. The results of this research prove that age group and the availability of the applications in the app store play a major role in choosing an operating system, due to this Android is highly popular [9]. N. Ahmad et al.(2015) This paper represents the difference between mobile operating systems in terms of the business market and their features. Based on the advantages and disadvantages of these operating systems the result shows [10]. Novac et al.(2017) This paper focuses on the comparison between the most used mobile OSs i.e. Android, iOS, and Windows Phone. In this paper, the author represents the most important features, similarities, and disadvantages of these mobile OSs. The author also provides a table comparing services offered by the three mobile operating systems[11].

Hamed et al(2017) This paper discuss the various mobile based operating systems like Google Android, Apple iOS, and Microsoft Windows Phone. The ratios of share market for these OSs are Android 47.51%, iOS 41.97%, and Windows Phone OS 2.57% [12]. Lazareska et al.(2017) Transformation of Android applications to iOS and their pros and cons are discussed. A model on android transformation is proposed by the author in this paper. Results showed that the most convenient software is iOS due to its safety and timely updates[13]. Chandrashekar et al.(2021) this paper discuss the main characteristics of using mobile devices. This paper also includes the security parameters while working with smart devices [14].

Garg et al.(2021) This paper reviewed the security aspects of Android and iOS. The author also focuses on finding the solutions for android‘s security as it is more vulnerable as compared to iOS[15]. Riasat et. al (2022) emphasis on three types of operating system and on the basis of result found in terms of popularity, price, adaptability and the functionality. Engberg et. al. (2023) in this book the author mainly discussed the comparison between Apple iOS and android mobile operating system and the important feature like GUI is also discussed in this paper. The difference between various icon are also here[18].


Figure 5: Architecture of the iOS Operating system [10]

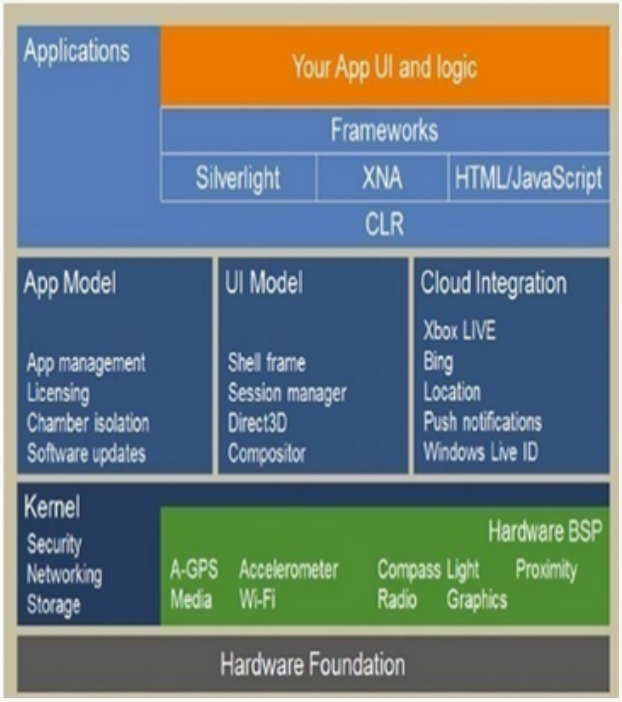


Figure 6 : Architecture of windows phone OS [6]

**Conclusion**

The three Operating Systems which we have discussed above have advantages as well as disadvantages. All three operating systems are providing advanced features and multitasking along with different interfaces as well as operating systems. Windows phones are discontinued due to some limitations. Therefore, nowadays the actual competition is in Google Android and Apple iOS because of the reliability, user-friendly, and security. Google Android mobile phones are customizable, affordable, user-friendly, open-source, compatible with a large number of applications and games, automatic backups and contain fewer restrictions whereas; Apple iOS mobile phones are more securable, faster, and more consistent. Hence, it is very difficult to choose the appropriate operating system. At the end, it all depends upon the user's choices and interests.

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# Deep Learning Segmentation Models


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**Deep Learning Segmentation Models**

Numerous Deep CNN-based segmentation models that have been produced in the past have been the subject of several literature reviews. The majority of the work has been made public; notable examples include the encoder and decoder portions, skip-connections, multi-scale analysis, and, more recently, the use of dilated convolution. As a result, it is difficult to talk about the specific contributions that each work made; nonetheless, it is easier to group them according to the basic architectural advancements that they made over previous works. These models can be divided into semantic, instance, and panoptic segmentation networks according to their architectural characteristics. Several Deep learning-based segmentation models utilized for recognition purposes namely Fully Convolutional Network model (FCN),UNet model,DeepLabv3+ model, Mask RCNN model and PointRend Segmentation model has been described in the following sections.

**Fully Convolutional Network Model (FCN)**

Pixel categories in an input image can be altered using a convolutional neural network called a fully convolutional network (FCN). Separation from classification difficulties is that segmentation requires assigning a class to every pixel [1]. Whereas classification solely takes into account the content of the input, segmentation additionally adds its location within the image.

An detailed design of the FCN is presented in Figure 4.1. Conventional image classification techniques that use convolutional neural networks to interpret input image go through a sequence of convolutional layers and fully connected layers where the image size is reduced. CNN needs to search farther to recover the deep properties, even while spatial position data is also lost. Performing upsampling is required in order to acquire an output size similar to the input size. Finally, element-wise addition is employed in FCN to fuse the output, producing an improved outcome. This is accomplished by utilizing a transposed convolution layer to restore the height and breadth of the intermediate layer feature map to the dimensions of the input image [2].

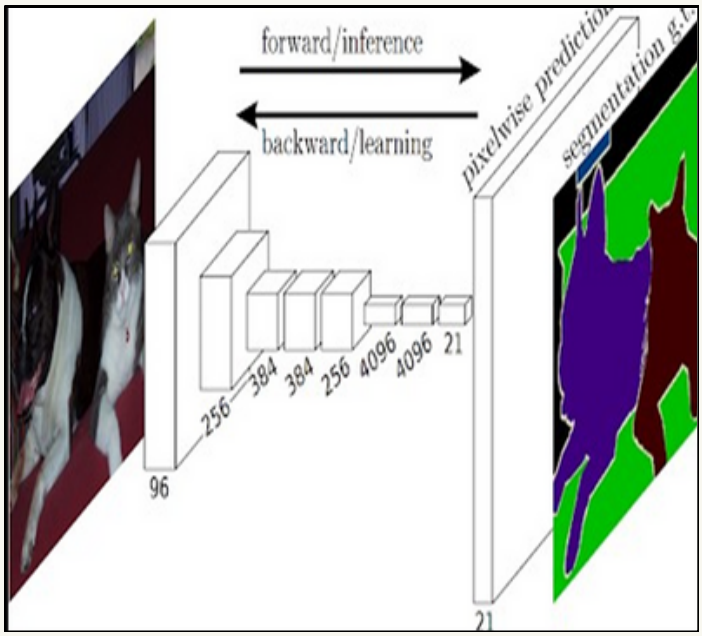


Figure 1 Fully Convolutional Neural Network [2]

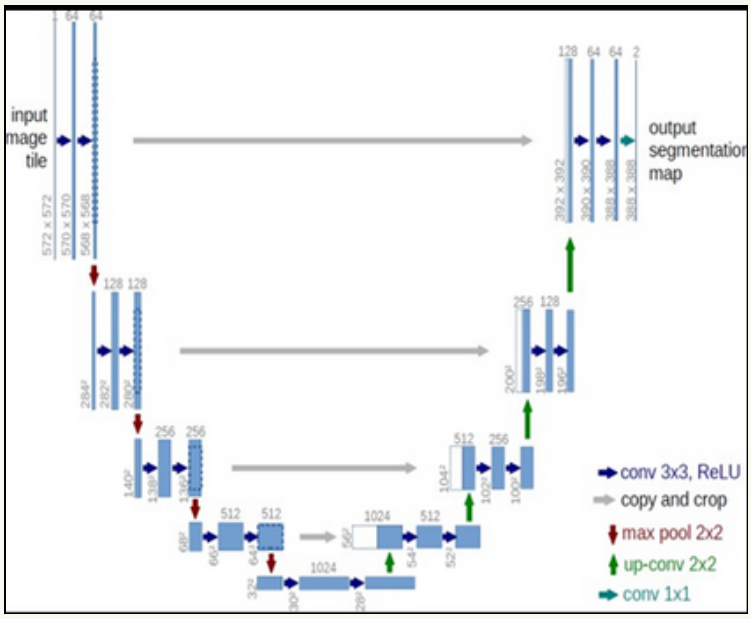


Figure 2 UNET Model [3]

**U-NET Model**

The three parts of the U-Net design are the bottleneck, the expanding path, and the contracting path, also known as the down-sampling path. By employing a contracting path with three-fold convolutions, the context of an image can be retrieved. The extending path results in fewer feature maps with larger proportions. The feature maps are then processed using a 1×1 convolution, as seen in Figure 4.2, to produce a segmentation map that classifies each pixel of the input image [3]. The proposed methodology consisted of various instance based as well as semantic based segmentation models like Deeplabv3+, Mask-RCNN and Point-Rend based models.

**Deeplab V3+ Segmentation Model**

Deeplabv3+ framework is necessary to carry out semantic segmentation, as demonstrated in Figure 4.3. "DeepLabv3+" utilizes an encoder-decoder structure. Here, DeepLabv3 encodes the rich contextual information, and for recovering various object boundaries, a modest and efficient decoder is adopted.

The DeepLabv3+ model employs an encoder-decoder architecture along with atrous convolution [4] that is utilized in both the DeepLabv3 and DeepLabv3+ models (shown in Fig 4.3). There are two foremost challenges associated with semantic segmentation through Deep Convolutional Neural networks, which are as follows: (1) reduction of feature resolution due to successive pooling operations or convolution striding (2) persistence of objects on various scales. Developing increasingly abstract feature representations and invariance to local image transformations that can interfere with prediction is the main challenge [5].

This kind of model also inculcates spatial pyramid pooling through encoder-decoder architecture. Although the primary layers contain convolution in addition to down-sampling operations, these operations are eliminated from the latter several layers. In spite of this, the up-sampling operation associated with consistent filter kernels is achieved. Moreover, numerous parallel arousal convolutions are employed at diverse scales [6]. Hence, it leads to deeper feature maps besides seizing context at numerous scales in comparison with Deep CNN.

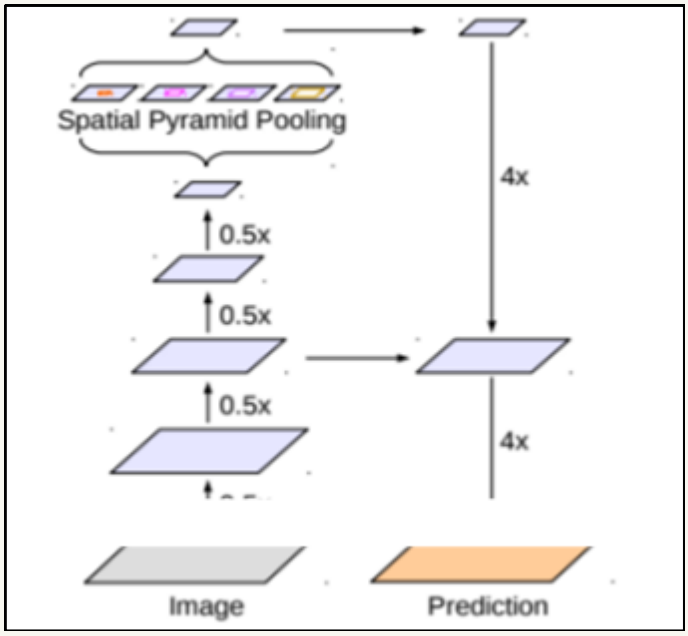


Figure 3 Deeplabv3+ model [4]

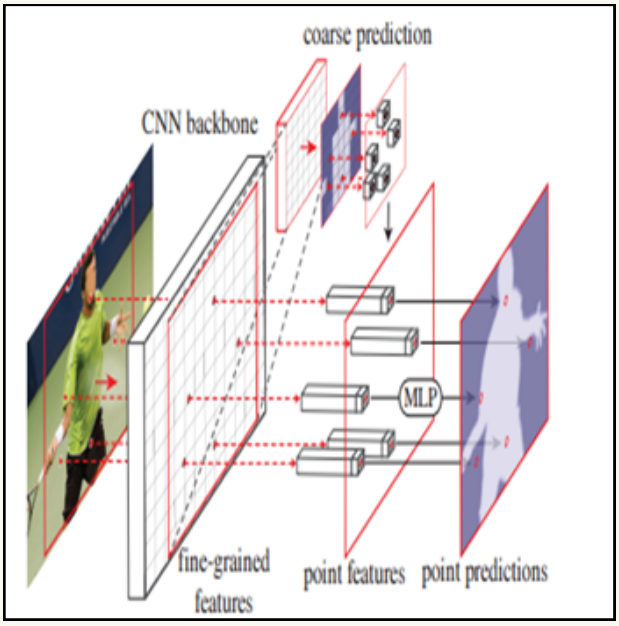


Figure 5 Architecture of Point Rend Model [10]

**Mask-RCNN Based Segmentation Model**

A cutting-edge segmentation model called Mask R-CNN was created on top of Faster R-CNN. Faster R-CNN is a type of region-based convolutional neural network [7] that provides bounding boxes and a confidence score for each object's class label. For calculating instance segmentation, Mask R-CNN is considered a conceptual model, as shown in Fig. 4.4. Then, adding third branch to the Faster R-CNN for getting an object mask as an output [8] was performed. Therefore, masking R-CNN is an ordinary and instinctive idea. However, this additional mask output discloses differences from the class and box outputs, necessitating the removal of a far more precise spatial structure of an object. Here, firstly, features are extracted through the DCNN, and formerly, region proposals are produced by virtue of the RPN layer. Finally, for classification and positioning purposes, feature maps with fixed dimensions are created. In order to get better segmentation performance, a mask branch is appended, although the eventual classification and positioning are executed [9].

**PointRend Segmentation Model**

The Point Rend architecture can be used for semantic tasks as well as instance segmentation. For example, point-reference segmentation is applied to each region. Through a coarse-to-fine approach of mask computation, it makes predictions over a predetermined set of points. Semantic segmentation can retain generality by treating the entire image as a single region. Fig. 4.5 depicts the Point Rend architecture design. Point Rend, sometimes known as point-based rendering, is a technique that uses point representations to fragment images [10]. A Point Rend module consists of three main parts: (i) By avoiding extreme computations for whole pixels in the high-resolution output grid, a point selection technique created predictions based on the selected small real-value points. (ii) Extracting the point-wise feature representation for each point that is chosen in order to envision a segmentation with a higher resolution than the one that was previously achieved. (iii) A point head: a trained tiny neural network predicts a label for each point, individually, based on the point-wise feature representation [11]. The Point Rend module, for example, can be used in any region for segmentation. On a set of chosen points, it executes computations for mask prediction using a coarse-to-fine methodology.

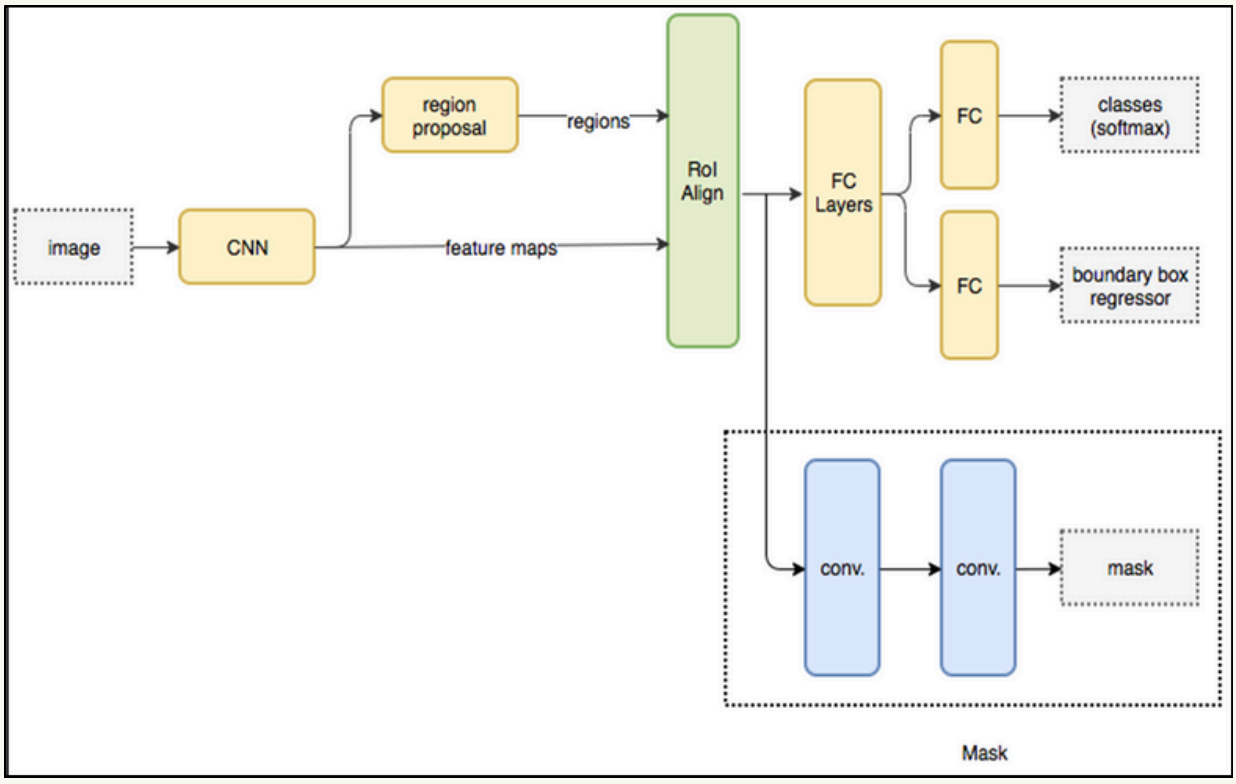


Figure 4 Mask R-CNN Architecture [7]

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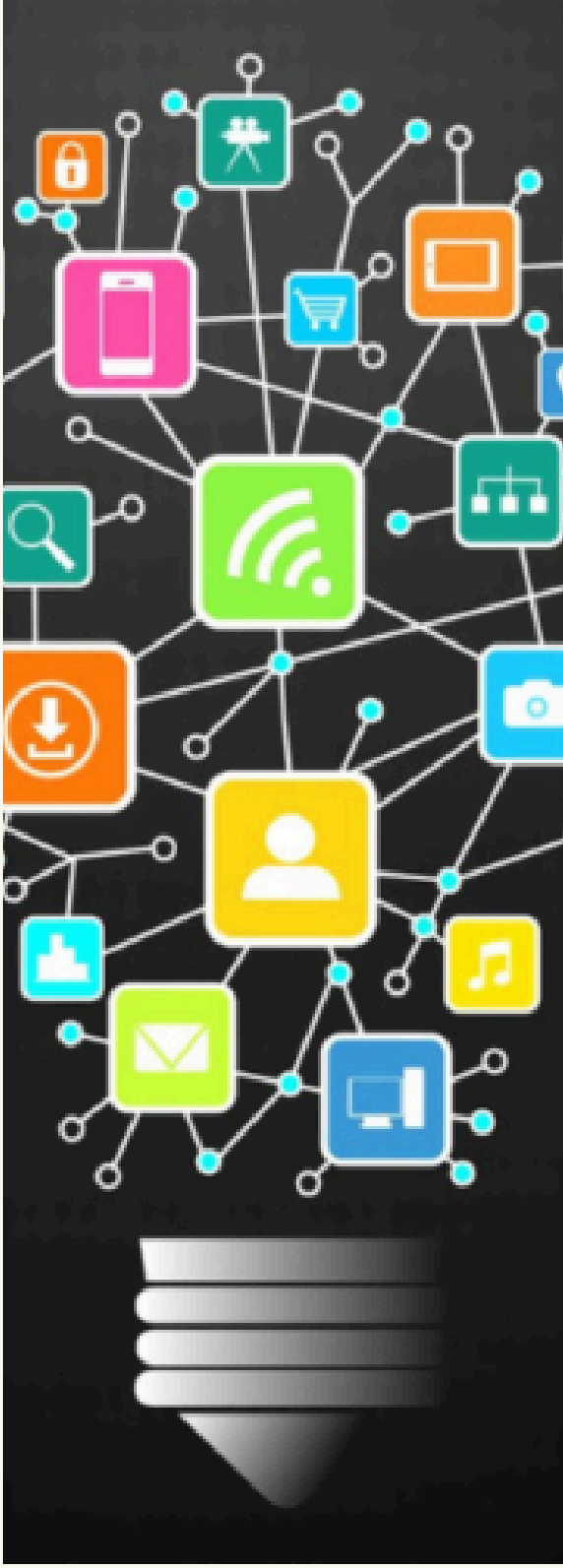
**Top 10 IT Companies in India**

# Emerging IoT Trends in Future



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**Introduction**

The Internet of Things (IoT) has experienced remarkable growth as a result of technological advancements and the increased demand for instantaneous insights into digital transformation solutions and activities.

The future of IoT is appearing more promising than ever as we advance into 2024 and beyond, with a plethora of emergent trends and forecasts. The potential for IoT is seemingly limitless, as evidenced by the advancements in Artificial Intelligence and Machine Learning, as well as the emergence of interconnected supply chains and smart cities.

Future of IoT in Digital World

Over the past few years, the digitalization of objects has experienced a significant increase, which has been facilitated by the widespread availability of inexpensive resources. This has enabled all individuals to access these trends [1].

However, it is impossible to discuss digitalization without the Internet of Things. In the present day, the implementation of IoT is essential for the growth of any business, as it is akin to a blessing to technology. Finance Online predicts that the number of IoT devices in use will exceed 25 billion within the next seven years.

It experienced substantial growth during the Covid-19 pandemic, which was primarily due to the increasing prevalence of remote monitoring and clever analytics.

Additionally, there has been a significant transition from non-IoT devices to IoT devices over the past decade.

The Internet of Things (IoT) has been seamlessly incorporated into a variety of aspects of our globalised economy and way of life, including interconnected consumer products like appliances, security systems, and automobiles, as well as large-scale manufacturing applications like those in agribusiness and power.

Businesses are misinformed about the most effective methods to integrate IoT into the issues they are currently facing as the number of connected devices increases.

However, more specifically, they must identify the most effective methods of guaranteeing cybersecurity in the future generations of a technology-driven world. This article will examine the most significant IoT advancements that we anticipate will emerge in 2024 [2].

**Top IoT Trends in 2024**

1. Blockchain
2. Smart Cities
3. IoT Powered with 5G Technology
4. Traffic Management
5. IoT-Empowered AI Applications
6. Digital Twins
7. Voice Activated IoT Devices
8. IoT Security
9. Metaverse

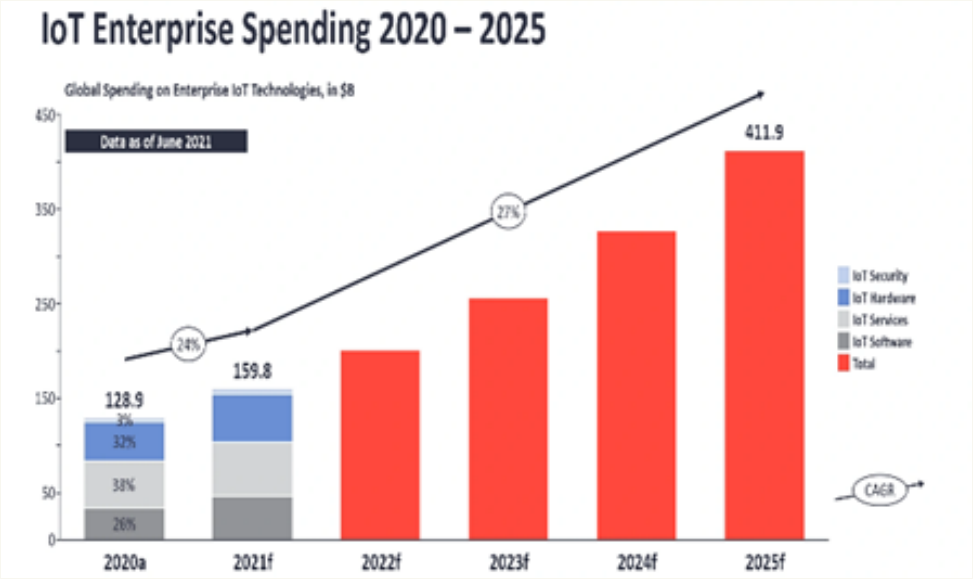


Figure 1 IoT Enterprise Spending 2020-2025

**Blockchain**

The proliferation of blockchain technology is one of the most recent Internet of Things (IoT) trends. It can facilitate the secure storage of data in IoT devices, facilitate the interaction between various network locations, and guarantee the preservation of accurate records. Consequently, Blockchain is an ideal choice for IoT applications, as they are distributed by nature. Moreover, Markets and Markets anticipates that the global blockchain IoT market will expand by USD 2,409 million by 2026.

Blockchain, a decentralised and distributed ledger technology, is currently assuming control over nearly all applications in banking, agriculture, finance, transportation, and other sectors.

**Smart Cities**

The Internet of Things is swiftly altering the landscapes in which people and innovation interact in innovative, more integrated, and intellectual ways. Smart cities are no exception: they employ data-driven technologies to address pressing issues and enhance resident amenities. This can lead to improved durability, decreased deviance, increased transit and availability, and social services.

The government will have the capacity to implement a variety of intelligent solutions. When discussing the Internet of Things (IoT) and emergent technologies, smart cities consistently develop ahead of the curve. In the past five years, numerous governmental institutions have initiated IoT technology initiatives that will significantly alter entire cities.

**IoT Powered with 5G technology**

5G is not merely the most recent technological advancement; it represents the beginning of a new era in which networking will become more dynamic and adaptable. The service will be precisely calibrated to meet the needs of customers, and 5G networks will implement modifications to applications.

Without a doubt, 5G technology is one of the most significant emerging technologies in the Internet of Things (IoT) in 2024. This is due to the fact that robust connectivity will lead to more reliable IoT devices. Network segmentation, real-time data processing, extensive coverage, and lower latency are among the features that 5G will include.

**Traffic Management**

The contemporary trends in the Internet of Things (IoT) indicate that IoT technology is pertinent for addressing global challenges such as traffic and blockage issues. Currently, a multitude of organizations are providing solutions and arrangements that employ IoT-integrated technology in vehicles and traffic systems to design more intelligent traffic networks, with the intention of reducing superfluous traffic and congestion.

Cities that implement smart-mobility technologies have the potential to reduce travel times by 15 to 20% on average by 2025, with some individuals experiencing significantly greater reductions, according to McKinsey. Consequently, cities and leaders are now recognizing that smart-city strategies cannot be implemented without the use of resilient technologies such as IoT, following a decade of trial and error.

**IoT-Empowered AI Applications**

According to statistics, it is feasible to anticipate the deployment of 64 billion IoT devices by 2025. Artificial Intelligence and the Internet of Things are frequently at the forefront of the list when it comes to the most recent IT industry technologies. The combination of artificial intelligence (AI) and the Internet of Things (IoT), two technologies that are fundamentally distinct, has the potential to offer commercial solutions [3]. These intelligent automation technologies not only facilitate the automation of routine tasks but also facilitate the formulation of decisions without human intervention. These two technologies can assist industries in automating numerous processes, reducing operating costs, increasing productivity, reducing downtime, and facilitating predictive maintenance.

**Digital twins**

A digital twin is a virtual representation that is the real-time digital equivalent of a physical object or process, and it was first identified in 2020. It can be employed for a variety of purposes, including the diagnosis, optimization, surveillance, and control of asset utilization and performance. By 2025, the digital twins market is expected to experience a combined annual growth rate that is several times greater.

The Internet of Things, artificial intelligence, and data analytics have been integrated by digital twin technology. Data scientists and other IT professionals can optimize installations for maximum efficacy and construct a variety of what-if possibilities by having a digital equivalent, which is facilitated by the interconnection and data provided by more complex "things."

**Voice-activated IoT devices**

Voice search is utilized by 27% of the global online population on their mobile devices, as indicated by data from Think with Google.

Consequently, the voice-based user interfaces have been elevated to a new level by the use of artificial intelligence-powered virtual assistants, such as the Google Assistant, the Amazon Echo, and the Siri virtual assistant developed by Apple. In the near future, voice interactions will be implemented in a variety of industries, enabling individuals to issue commands, modify settings, and receive results from smart devices, as a result of the advancements in technology. Voice biometry is an additional thrilling advancement in the field of voice recognition technology. Businesses are certain that this approach will be more dependable than the current methods.

**IoT Security**

The IoT security market is anticipated to increase from 34.2 billion in 2022 to 38.7 billion in 2023, according to Statista's report. Security is a developing IoT trend, and numerous enterprises worldwide are implementing IoT. In today's world, security is a significant concern due to the extensive level of connectivity in which we are engaged. The ongoing threat to unsecured connected devices/things has been underscored by the increased intervention of technology in the lives of individuals. Thus, security is a developing IoT trend, and numerous businesses worldwide are creating IoT security solutions that incorporate a variety of technologies.

**Metaverse**

By 2030, the global metaverse market is anticipated to reach $679 billion, as per Grandview Research. The Metaverse framework is dependent on IoT to optimize its capabilities. It is highly probable that the tech industry will generate novel opportunities for expansion and growth as a result of the interaction between the Internet of Things and Metaverse.

The metaverse's implementation in a diverse array of industries, such as games, entertainment, media, eCommerce and retailing, training, manufacturing, architecture, and engineering, is expected to drive its expansion.

**Conclusion**

The future of IoT is set to experience exponential growth and innovation, which will be fueled by advancements in connectivity, AI, edge computing, and a concentration on sustainability and security [4]. These trends will not only revolutionize industries and urban infrastructure, but also enhance the quality of life for individuals, thereby establishing IoT as a critical component of the digital future [5].

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# Global Inclination Towards India for Knowledge Process Outsourcing


Global firms are facing increased difficulty in introducing new products and services as a result of the increasingly competitive market. In light of this, companies should look for ways to improve business activities while also reducing costs. Here is where KPO, or knowledge process outsourcing, might be useful for these businesses in meeting their goals. Rather than recruiting and training specialist individuals internally, businesses can obtain expertise from a third-party vendor by implementing a Knowledge Process Outsourcing (KPO) strategy. In India, the KPO sector provides services at reasonable costs, including IT services, legal procedures, and data analytics. This makes India the ideal KPO location by assisting businesses in increasing profitability, gaining access to specialized professionals, and producing high-quality final goods[1]. This article will illuminate us more about the benefits, drawbacks, and commonly outsourced procedures of the Indian KPO sector.

**An outline of the Indian KPO sector**

Business Process Outsourcing (BPO) includes KPO as a subset [2]. Under the KPO model, companies contract with outside vendors in nations like China, India, and the Philippines to handle information-based business tasks including data analytics and financial services. Compared to the BPO sector, these operations require experts with more technical understanding, such as programming and software proficiency. It could be costly to hire such workers in western nations like the USA, UK, etc. However, why has India become one of the world's most popular KPO destinations? India now accounts for about 70% of the global KPO market because to its remarkable recent expansion in the KPO sector [3]. The primary causes of this amazing growth are: 1) Availability of KPO specialists with extensive qualifications. 2) cutting-edge technologies and software. 3) Asia's sixth highest level of English language competency. 4) well-known ITES (information technology-enabled services) and KPO service companies. 5) adoption of Six Sigma and ISO 9000 quality standards. 6) Multiple KPO business models.

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KPO can manage the following set of activities: (A few of the Examples)
1.Activities related to investment research
2.Activities related to market research
3.The analysis of data
4.Services related to business research
5.The outsourcing of legal processes
6.Activities related to engineering services
7.Activities related to data analysis and data management
To meet the varied demands of their clients, the Indian KPO industry provides three distinct models of knowledge process outsourcing:

**Captive Business Model**
A captive business model involves a foreign company establishing centers in countries that provide operational efficiency, low prices, and experienced workers [4]. These captive centers serve just the parent company's needs. Because building captive centers in foreign countries takes a significant expenditure, large corporations typically follow suit. McKinsey, Morgan Stanley, JP Morgan, Deutsche Bank, and Goldman Sachs are some of the corporations holding captive centers in India.

**Third-party service providers**
In India, many small and major companies provide KPO services. If you do not have the means to establish your own captive center, you can outsource your KPO processes to these third-party providers.
These third-party service providers serve many clients, which increases their domain competence and specialty. Mostly third-party agencies operate on a project basis. Some third-party service providers personalize their services to their clients' specific needs. Aranca, Evalueserve, and WNS are among India's most popular third-party service providers.

**Hybrid Business Model**
It is essentially a hybrid outsourcing model where a local, outside provider establishes a captive center on behalf of a business, offering them all the required office resources, people, and technical infrastructure while maintaining complete control over how everything is run and managed [5]. Though the vendor partner maintains the center completely, it feels like a client's own office. Such a model is becoming more and more common in India, and outsourcing experts think it could eventually become the norm for the IT sector.

**Employment Opportunities**
Since many nations, like the US and the UK, prefer to outsource their work to nations like India, Bangladesh, Pakistan, and other Asian countries, the job prospects in a KPO are rather good.
Freshmen can search online job sites for openings for process executives. If you're an experienced expert looking to get into the KPO sector, you can look into openings in the following divisions: IT Legal services, training and consultancy, content management, operations management, research and analytics, and data analytics.

**Compensation Package**

Beginning salaries for KPO personnel range between Rs 10,000 and Rs 40,000. The salary is wholly determined by the shift requirements and level of difficulty of the offered position. Nonetheless, career advancement in this field is quite rapid, and it is possible to attain the position of team or group leader within a few years. The only thing that matters is exemplary performance. if you've met the requirements and are interested in a career path that lets you travel internationally often, then join KPO sector.

**Conclusion**

India is a well-liked KPO destination because of its huge knowledge base, higher scalability, and customized services. Performance monitoring could present some challenges, but they are easily resolved with the right outsourced partner. One can outsource tasks such as data administration, legal services, research and development, etc., to employ exceptionally competent professionals available in the country.

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# Dark Energy and Unseen Forces: A Journey Beyond Light

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Light is the flow of basic three-dimensional matter corpuscles that releases work in the form of radiation from electromagnetic waves. A photon, which is a unit of light, is a basic three-dimensional particle of matter. A photon is made up of both the matter and the accompanying energy components, which work together to support and maintain the stability of the entire photon entity. A disc-shaped entity rotating around one of a photon's diameters represents the matter at the centre of the particle.

**Introduction**

Light, the enigmatic phenomenon that permeates the cosmos, has been the subject of profound inquiry since the dawn of scientific exploration. Traditionally understood as a stream of electromagnetic waves, recent investigations reveal a more intricate reality. This exploration delves into the essence of light, proposing a paradigm that redefines its fundamental nature and challenges conventional wisdom.

Central to this investigation is the assertion that light is not merely an abstract wave but a flow of basic three-dimensional matter corpuscles accompanied by electromagnetic energy radiation—a concept that transforms our understanding of the composition of light itself. At the heart of this revelation lies the identification of the basic unit of light: the photon.

Each photon, a three-dimensional matter particle, comprises a matter-part and an accompanying energy-part, collectively forming a cohesive entity that sustains its existence and stability.[1]

The matter-core of a photon, characterized by a disc-shaped body spinning about one of its diameters, serves as the epicentre of its physicality. The surrounding electromagnetic wave-like entity manifests as work, presenting itself in the form of distortions in the universal medium. This two-dimensional energy field, constructed by latticework structures created by quanta of matter, extends beyond the confines of the three-dimensional matter particle, constituting an all-encompassing universal medium.

This groundbreaking exploration endeavours to unravel the mysteries shrouding light, offering a novel perspective that not only questions established doctrines but also lays the foundation for a

deeper comprehension of the intricate interplay between light, matter, and the universal medium.

**Universal Medium**

The "Hypothesis on MATTER" proposes an overarching concept of an all-encompassing universal medium referred to as "2D energy fields," which occupies the space outside basic three-dimensional matter particles, specifically photons. These 2D energy fields are characterized by a well-defined structure, constituents, and a logical mechanism governing their development and stabilization. The hypothesis posits the existence of a singular type of matter particle known as "quanta of matter," with an infinite number of these quanta filling the entirety of space.

The structure of 2D energy fields involves the formation of a latticework structure by 1D quanta of matter. Adjacent free quanta of matter adhere to each other, forming end-to-end chains in space. The concept suggests that the number of such chains, perpendicular to each other in the same plane, completes the structure of a 2D energy field.

Within a stable region of a 2D energy field, the quanta of matter forming junctions in the latticework are held at right angles to each other in the same plane. Distortions in the latticework, caused by external forces, lead to instability at these junctions. To restore stability and regain the serenity of the 2D energy field, distortions are transferred successively from one junction to the next in the direction of the original effort causing the distortion. This process involves the transfer of distortions within the 2D energy fields while the fields themselves remain steady in space.[1]

**2D Energy Field**

The hypothesis posited in "Hypothesis on MATTER" introduces a conceptual framework centered around an all-encompassing universal medium known as "2D energy fields," which occupy the space outside basic three-dimensional matter particles, specifically photons. These fields, characterized by definite constituents, structure, and mechanisms of development and stabilization, are envisaged to play a crucial role in shaping the nature of matter and motion within the cosmos.

In this theoretical construct, 2D energy fields are proposed to be constructed from latticework structures formed by 1D quanta of matter. These quanta, create end-to-end chains in space, and their configurations in planes give rise to stable 2D energy fields. These fields, extending infinitely in their own spatial planes, replace the conventional notion offering a new perspective on the medium through which light and matter interact.[2]

The motion of basic three-dimensional matter particles through 2D energy fields involves the ejection of the matter-core of a photon from each of the 2D energy fields of its existence. As a matter particle advances, the latticework in front of it parts to create a path, while the latticework at the rear joins back to restore continuity. The linear motion of matter particles is attributed to the inherent ejection mechanism, balanced by pressure from the front due to collisions with quanta of matter in the latticework.

**Light**

The phenomenon of light, encompassing similar radiations, is elucidated through the framework of the "Hypothesis on MATTER." Light is posited to be composed of numerous matter-corpuscles propelled by associated distortions in 2D energy fields, collectively referred to as photons. The matter-body of a photon, being a disturbance, undergoes continuous ejection from 2D energy fields, resulting in the constant magnitudes of its motions. This perpetual ejection mechanism maintains the photon's motion at constant speeds, both linear and angular, dictated by the capabilities of the 2D energy fields in any given region of space.

Electromagnetic waves are conceptualized as the transfer of periodically varying distortions through these 2D energy fields, constituting a universal medium. The spin motion of a photon's matter-body generates cyclically varying distortions in the transverse plane, which, when observed, appear as wave-like motion. These distortions share common properties with electromagnetic waves and can be considered as the electromagnetic wave-parts of photons. A photon is then described as a combination of a single pulse of this electromagnetic wave and the spinning disc-shaped matter-core.[1]

**Photon [3]**

The intrinsic properties of a photon, as outlined in the "Hypothesis on MATTER," are characterized by its motion at a constant linear velocity, with its spin motion at an angular speed proportional to its matter content not considered in this discussion. A stable photon exists due to its consistent motion at critical constant velocities with respect to the 2D energy fields surrounding it. The maintenance of this critical linear velocity is imperative for the stability of the photon, and any instability is rectified by continuous gravitational actions exerted by the 2D energy fields.

The matter-part of a photon's core-body is described to have a segmented spherical (disc) shape, undergoing continuous compression by gravitational actions to maintain its integrated form. Gravitational actions act effectively on the convex curved surfaces of the photon's disc-body, maintaining a constant radial size. The inertial pocket of a photon shapes its spinning core-body continuously to ensure that the convex curvature of the forward-facing disc-face is consistently less than that of the rearward-facing disc-face. This regulation of the instantaneous shape of the core-body by gravitational actions allows the photon to move at a critical constant linear speed through 2D energy fields in space.

**Stability of Photon's Linear Speed**

The stability of a photon's linear speed, according to the "Hypothesis on MATTER," is intricately tied to the transfer of distortions in the 2D energy fields, which carry the core-bodies of photons within their region and influence the displacement of photons in space. The inertial pocket, a result of these distortions in the universal medium surrounding a photon's core-body, determines the photon's linear and spin motions.[3]

Alterations in the relative displacement between a photon's inertial pocket and core-body introduce instability to the photon's motion. Forward displacement of the core-body relative to its inertial pocket increases the photon's linear speed, while rearward displacement reduces it. An increase in ejection from the rear without a corresponding increase in resistance from the front can lead to an apparent increase in the photon's linear speed, potentially induced by attractions from another matter body. This process may result in excess external pressure and the assimilation of quanta of matter from the latticework structure into the photon's core-body.

Conversely, a reduction in ejection from the rear, without a corresponding reduction in resistance from the front, tends to decrease the photon's linear speed. The core-body may shift rearward relative to the inertial pocket, leading to a slowdown. This reduction in linear speed may result from apparent attractions from another matter body, causing a reduction in ejection and an increase in resistance.

**Speed of an Electromagnetic Wave**

The speed of an electromagnetic wave, as described in the context of the "Hypothesis on MATTER," is closely linked to periodically varying distortions radiated in the 2D energy fields, which constitute the universal medium. In this conceptualization, electro- -magnetic waves are generated by electromagnetic actions within atoms of an electric conductor.

These electromagnetic actions are in turn initiated by photons moving in circular paths within the primary 3D particles of the atoms.
The linear speed of photons in their curved paths within the primary particles of atoms determines the speed of radiation of distortions or electromagnetic waves in the 2D energy fields. Consequently, the speed of electromagnetic wave radiation is considered equivalent to the linear speed of photons. Any alterations in the speeds of photons within a medium have an identical impact on the speed of electromagnetic waves.

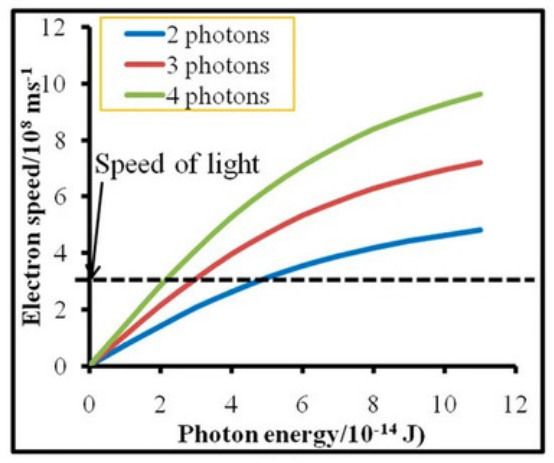

Figure1: Speed of Light

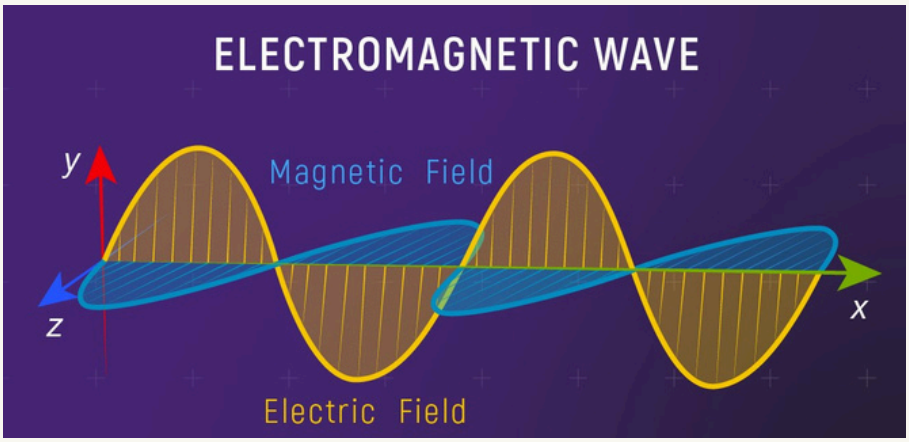

Figure2: Electromagnetic Wave

**Speed of Light**

According to this hypothesis, the linear speed of light in a specific region appears to be slower when measured with respect to more massive macro bodies, as the density of distortions affects the distance moved by a photon in unit time. The concept of "absolute unit of time" is introduced, suggesting that time within a matter field depends on the distortion-density of the 2D energy fields in that region.[1]
Lastly, the section touches on the relative motion of photons and the failure of experiments, such as the Michelson and Morley exp., to register any diff. in the linear speeds of light beams moving in various directions within the same matter field of Earth.

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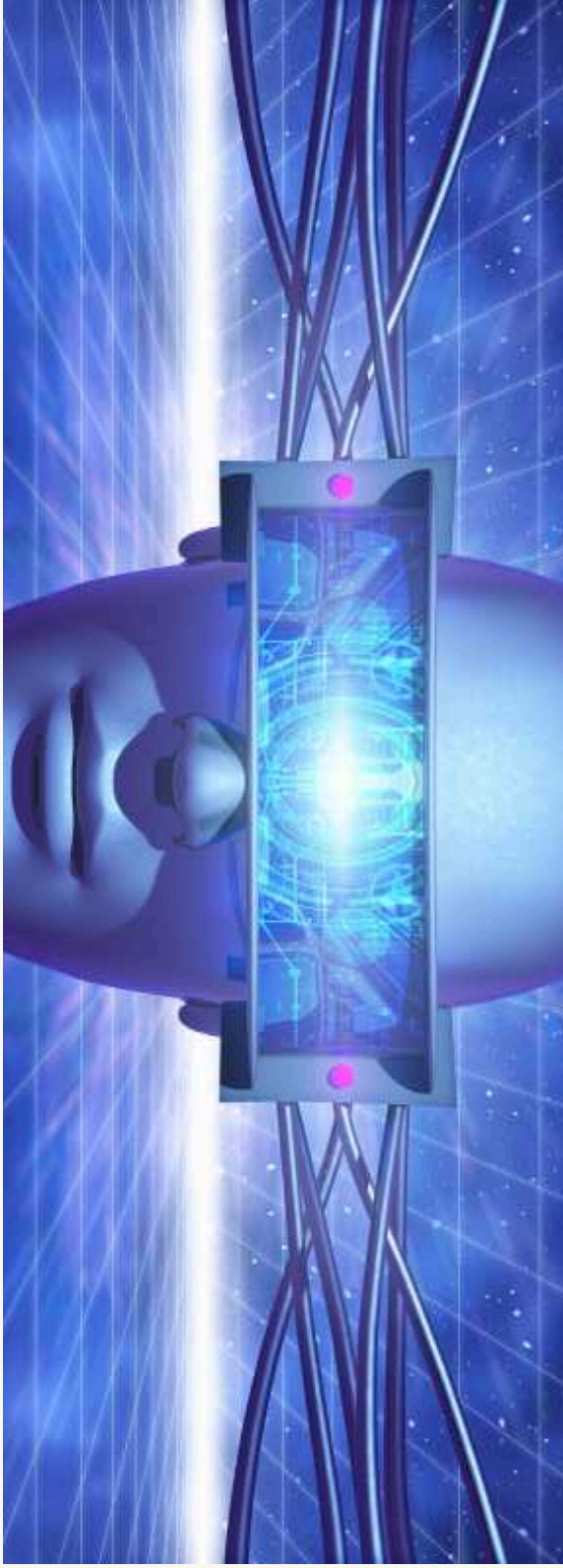
# Immersive Technology



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**Introduction to Immersive Technology**

Immersive technology combines the real world with the digital one which creates exciting experiences that feel real. Various gadgets and computer programs are used to make interactive worlds where all sorts of cool stuff is done. With immersive technology, a user could explore virtual places, work together in a digital room, and play in make-believe worlds. It is used in different jobs such as teaching, medicine, and entertainment. A lot of amazing things like going on adventures without leaving the house could be done with the help of immersive tech. It even provides assistance in learning and developing skills. The experience it provides is like stepping into a storybook and making it our own [1].

Like an assortment of candies, Immersive technology offers various experiences such as:

· Augmented Reality
· Virtual Reality
· Mixed Reality

**Augmented Reality**

Augmented reality (AR) is like adding fun things around yourself with the help of a pair of special glasses. AR blends digital pictures, information and even cartoons with the real world. It's like seeing colourful drawings on buildings and helpful signs floating in the air while walking down the street. It is a hidden treasure of cool stuff that makes everyday surroundings more interesting. AR makes the world a more exciting place to be whether you are playing with friends, learning about history using digital displays or even finding your way with virtual signs [1].

**Virtual Reality**

Virtual reality(VR) will take you away to uncharted realms by putting on sleek goggles. It gives the experience of stepping into a huge video game or blockbuster movie where the surroundings can be felt. It lets you transverse various landscapes, interacting with objects and even engaging with characters as if they were real with the help of technology. VR offers an unparalleled adventure either by letting you explore ancient ruins, battling space invaders or crafting your digital masterpiece it provides experience to realms of the extraordinary [1].

**Mixed Reality**

MR is akin to possessing a superpower that enables you to exist in two worlds, the real and the make-believe, at the same time. The use of some glasses or gadgets is what makes you able to bring the virtual stuff into the real world or put the real stuff into the virtual world. You are standing on the verge of two worlds, which is why you have these experiences, that put you through a state where you start doubting what is real and what is not. MR allows you to mix the real and fantastic as your imagination can get completely wrapped up in all the thrilling and mind-bending possibilities, and you might forget what the limits of reality are [1].

**Everyday Applications of AR and VR Technology**

- Education: Platforms such as Google Expeditions and AR flashcards can make learning entertaining and interactive.
- Healthcare: VR is employed for PT, PTSD treatment and medical training simulations and thus the quality of care and learning is enhanced.
- Entertainment and Gaming: Utilities such as Oculus Rift and games such as Pokémon GO provide new levels of interaction and entertainment.
- Retail and E-commerce: AR apps from IKEA and Sephora allow users to see how products will look in their homes or on themselves.
- Real Estate: VR and AR apps give virtual house tours and help with home decor visualization.
- Travel and Tourism: VR provides virtual destination previews, while AR enriches the navigation with directions.
- Workplace and Remote Collaboration: VR platforms like Spatial facilitate virtual meetings and AR assists in remote maintenance tasks.
- Social Media and Communication: Platforms such as Instagram and VRChat provide AR filters and VR spaces for fun, interactive communication [2].

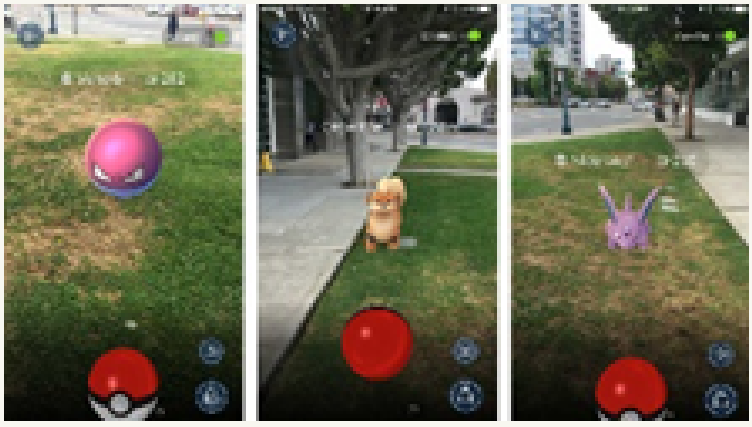

Figure 1: Gaming in AR [10]

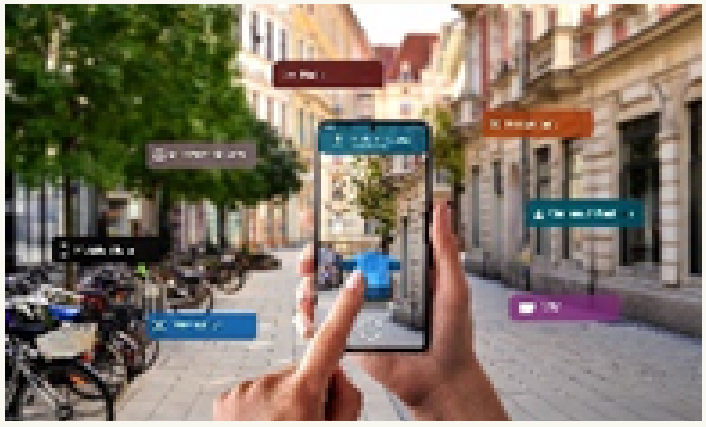

Figure 2: AR in Tourism [11]

**Job Opportunities in Immersive Technology**

Immersive technology is in full swing, and it includes VR, AR, and MR. However, it's not only the homeless that are affected by this! Not to mention Projection Mapping, Holographic Projection, and even Dome Projection for Planetariums and Flying Theatres. India is now becoming a hotbed for immersive tech, which means lots of career opportunities for people with skills in these specialized areas. If you have the knack for this field, you are in for a ride as India's immersive technology community has a lot of opportunities for you [3].

With immersive technology becoming more popular in India, there are lots of job chances in this cool and fast-changing area. In India's immersive tech scene, there are many different kinds of jobs, like:

- AR/VR Developer: Develop games, entertainment, and healthcare that are immersive by using languages such as C++, Unity, and Unreal Engine.
- CG Artist: Instills skills to create 2D and 3D models and animations for gaming, film, and advertising by using software like Maya and After Effects.
- Game Developer: Make up various games for different platforms like C++, Java and Python using these languages.
- UX Designer: Create intuitive interfaces that will allow for full immersion, working closely with developers and artists.
- Project Manager: Is responsible for the management of projects from the beginning to the completion, to make sure that they meet the set deadline and budgets.
- Projection Content Creators: Installs projectors and all the related equipment to be used in the projection mapping, in close collaboration with the designers.
- Projection Mapping Project Manager: Supervises the projections mapping projects and makes sure that they are of high quality and are delivered on time.
- Projectionist: Composites project resources into one to create a real image, which is responsible for mapping and blending.
- Projection Designer: Developing the concept of shows, software for parallel projections is being used to attract the attention of the audience.

**Skills Required for Immersive Technology Jobs [4]:**

- 3D Modeling Software: Adept at using 3D modelling tools like Unity, Blender, or Maya for creating realistic visuals.
- VR Hardware Understanding: VR headsets and controllers are known to me. I am well aware of their functionality and how they are used in immersive experiences.
- Interactive VR Programming: Skilled in using programming languages like C# or C++ for developing VR content that is interactive.
- UX/UI Design Principles: Is able to apply the fundamentals of user experience and interface design developed specifically for virtual reality settings.
- Design and Artistry: Having a strong skill set in design and art for making engaging virtual environments and assets.
- Conceptualization Skills: Can conceptualize and storyboard the VR experiences that will involve users fully.
- Spatial Audio Design: Proficient in spatial audio and sound design to provide a realistic experience in VR environments.

- Communication Skills: Successful communicator and collaborator, experienced in working in multidisciplinary teams.
- Project Management: Experienced in the whole process of VR design projects from the beginning to the end.
- HCI and UX Design: Familiar with human-computer interaction and user-centered design principles to create intuitive VR experiences.

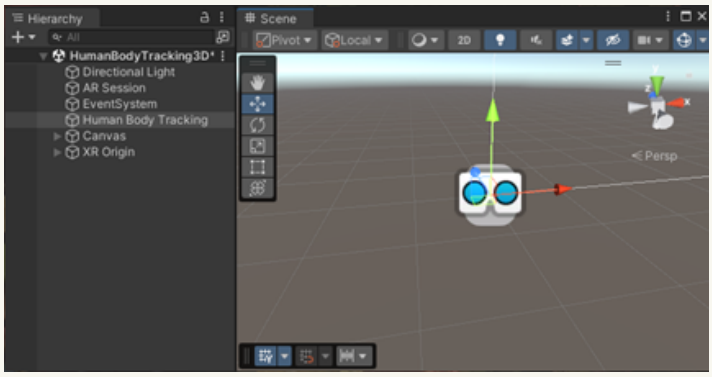


Figure 3: AR Foundation in Unity3D

**Current Leaders of Immersive Technology in India [5]**

India's immersive technology sector, encompassing AR, VR, and spatial computing, is swiftly advancing. Here are notable leaders:

India is swiftly advancing in the immersive technology sector encompassing AR, VR and spatial computing. Some of the notable leaders are:

- Fifth Dimension Technologies Pvt Ltd: Designs VR/AR standout content, targeting main sectors inclusive of market startups, enterprises, and social ventures.
- Niyati Technologies: Innovators looking into AR/VR solutions with research labs interested in IoT, machine learning, and blockchain in their area of expertise.
- InnoViz Technologies: Successfully did a trial with ready-for-winter InnovizTwo LIDAR and technologies of perception, making sure that ventures are highly reliable even in the most adverse conditions.
- TechAhead: Developers who advance apps that leverage modern technologies and are experienced in providing the best user experience. There is no doubt that this has contributed to Domino’s conversion rates which have increased significantly.
- Imagination Technologies: Revolutionize education, healthcare, and entertainment via immersive technology which basically constitutes our agenda for discussion on their power.

**Conclusion**

To sum up, immersive technology is truly a new frontier of merging the real and virtual worlds with alluring experiences that break the limits of the traditional ones. AR, VR, and MR can be used for exploration, entertainment, and innovation purposes in a different way. From improving education and health care to changing entertainment and gaming, the applications of immersive technologies are really wide and varied. The promising sector leads to great job opportunities, with India becoming a hotspot for VR creation and inventions. As the front runners and leaders persistently cross the frontier of what is presently possible, the future of immersive technology in India and beyond is sure to be both thrilling and transformative [6].

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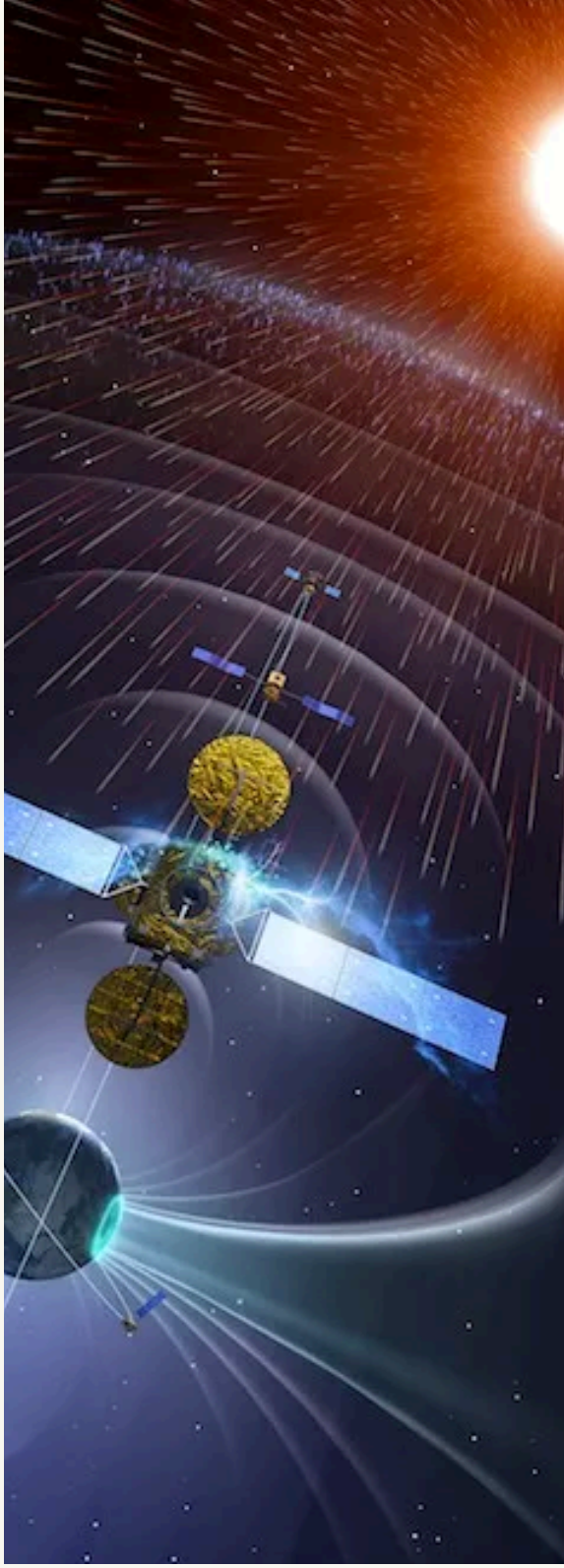
# Guardians of the Galaxy: How Space Radiation Affects Astronauts



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Space exploration presents numerous challenges, with astronaut health being a paramount concern. Among the various hazards, space radiation stands out due to its potential to cause severe biological damage. This article explores the nature of space radiation, which includes galactic cosmic rays, solar particle events, and trapped radiation belts, and its impact on the human body. Key health risks include DNA damage, acute radiation syndrome, increased cancer risk, cognitive impairments, cardiovascular issues, and other potential effects like cataracts and weakened immunity. The article also discusses current mitigation strategies such as advanced radiation shielding, pharmaceutical countermeasures, careful mission planning, continuous radiation monitoring, and genetic research.

**Introduction**

For many years, humankind has been fascinated with space travel, which has propelled technological developments and deepened our understanding of the cosmos. As we get ready for longer missions—like possible trips to Mars and beyond—it is more important than ever to protect the health and safety of astronauts. Radiation is one of the biggest hazards in the space environment. Astronauts are subjected to high radiation levels in space, which can have a significant negative impact on their health, unlike on Earth, where the magnetic field and atmosphere offer significant protection.

Radiation trapped in the Van Allen belts[1], solar particle events (SPEs), and galactic cosmic rays (GCRs) make up most of the complex combination of particles known as space radiation. Because of its great intensity and ability to pierce biological tissues, radiation poses different problems to different kinds of radiation. Creating strong defences requires an understanding of the nature of these radiations and how they affect the human body.

This article explores the several elements of space radiation, looking at how it affects astronaut health and the methods used to lessen the hazards.

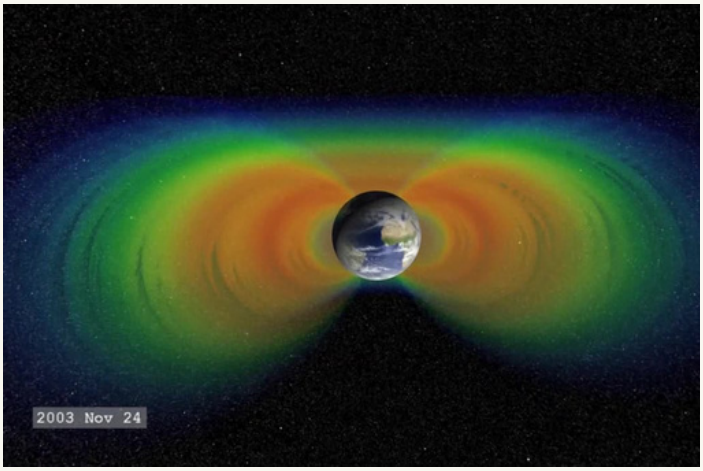


Figure [1] Van Allen radiation belt – Wikipedia

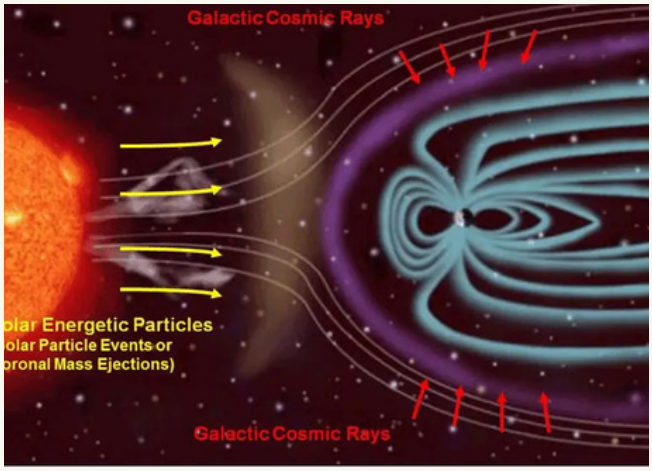


Figure [2] Geomagnetic storm – Wikipedia

**Understanding Space Radiation:**

The radiation encountered in space differs significantly from that of Earth. It is made up of high-energy particles that come from different sources and each one presents a different risk to astronaut health. Galactic cosmic rays, solar particle events (SPEs), and trapped radiation belts like the Van Allen belts are the main sources of space radiation [1].

**Galactic Cosmic Rays (GCRs):**

High-energy particles known as galactic cosmic rays originate from sources outside of our solar system, most likely supernova and other high-energy astrophysical events. While protons make up the majority of these particles, they also contain heavier ions like helium nuclei and completely ionised nuclei of other elements[2].

**Solar Particle Events (SPEs):**

Solar particle events, which include solar flares and coronal mass ejections, are bursts of energetic particles released by the sun, usually during times of increased solar activity. Large amounts of protons and, to a lesser extent, heavier ions can be released during these occurrences. SPEs can result in brief exposure to high levels of radiation, particularly if astronauts are participating in extravehicular activities (EVAs) outside of their spacecraft's shield[2].

**Trapped Radiation Belts:**

The Earth's magnetic field keeps the trapped charged particles in the Van Allen belts, which surround the planet. The primary elements of these belts are protons and electrons. Although spacecraft that are en route to the Moon or Mars traverse these belts somewhat rapidly, extended exposure on specific missions.

**Characteristics and Challenges:**

The main problem with space radiation is that these particles have a high energy and can penetrate deep into space. In contrast to radiation on Earth, which is frequently prevented or reduced by rather straightforward barriers, radiation in space necessitates sophisticated shielding methods to properly safeguard humans.

The unpredictability of solar particle occurrences is a serious obstacle. Galactic cosmic rays provide a steady background radiation level, but sudden, variable-intensity SPEs can also happen. Because of this unpredictability, astronaut safety during solar storms depends on reliable monitoring systems and fast response processes.

**Biological Effects of Space Radiation:**
Space radiation's high-energy particles are extremely dangerous to human health. Space radiation can significantly enter biological tissues, in contrast to the comparatively low-energy radiation seen on Earth, and can have a variety of immediate and long-term negative impacts on health. Understanding these impacts is vital in guaranteeing the security and welfare of astronauts during extended missions[4].

**DNA Damage:**
The ability of space radiation to harm DNA is one of its most important effects. High-energy particles could neutralise chemicals inside of cells or directly break DNA strands, resulting in indirect damage. Mutations brought on by this harm have the potential to cause cancer and other hereditary illnesses. While some DNA damage can be repaired by the body.

**Acute Radiation Syndrome (ARS):**
Acute Radiation Syndrome (ARS) can be brought on by brief exposure to high radiation doses. ARS symptoms can appear hours or days after exposure and include nausea, vomiting, drowsiness, and appetite loss. Severe cases may result in burns to the skin, hair loss, and internal organ damage that may be deadly.

**Increased Cancer Risk:**
Cancer risk rises dramatically with prolonged space radiation exposure. Research on radiation therapy patients and survivors of the atomic bomb provide light on how radiation exposure can increase the risk of cancer. Thyroid, lung, breast, and digestive tract cancers are most common in astronauts. Galactic cosmic ray heavy ions are particularly worrisome because they leave behind extensive ionisation trails in tissues that result in complicated DNA damage that is more challenging for the body to repair may lead to damage of cells.

**IV Mitigation Strategies[3]:**
Given the significant health risks posed by space radiation, developing effective mitigation strategies is essential for the safety and success of long-duration space missions. Researchers and engineers are working on various approaches to protect astronauts from radiation exposure. These strategies include advancements in spacecraft design, pharmaceutical interventions, mission planning.

**Radiation Shielding:**
Effective shielding is a primary method for protecting astronauts from space radiation. Several materials and techniques are being explored[4]:

1. Advanced Materials: Materials rich in hydrogen, such as polyethylene, are effective at absorbing radiation. Research is also ongoing into the use of innovative materials like hydrogenated boron nitride nanotubes, which offer superior radiation protection while being lightweight.

2. Water and Fuel: These resources can be used as a radiation shield. Water is excellent for absorbing radiation and can be incorporated into the spacecraft's walls or used to shield sleeping quarters and workspaces.
3. Spacecraft Design: Designing spacecraft with dedicated radiation shelters can provide temporary refuge during solar particle events. These shelters can be strategically placed within the spacecraft to maximize protection using existing mass, such as water tanks and other supplies.

**Mission Planning:**

Careful mission planning can significantly reduce radiation exposure:

1. Timing Missions: Planning missions during periods of low solar activity (solar minimum) can reduce the risk of exposure to solar particle events.
2. Trajectory Optimization: Choosing flight paths that minimize time spent in high-radiation areas, such as the Van Allen belts, can also reduce exposure.
3. Extravehicular Activity (EVA) Scheduling: Limiting EVAs to periods of low solar activity and monitoring space weather forecasts can help minimize exposure during these high-risk activities[3].

**Conclusion**

Mitigating the effects of space radiation is a complex challenge requiring a multifaceted approach. Advances in shielding technology, pharmaceutical interventions, mission planning, and continuous monitoring are crucial for protecting astronauts on long-duration missions. As research progresses, these strategies will become more refined, ensuring the safety and health of astronauts as humanity ventures further into space.

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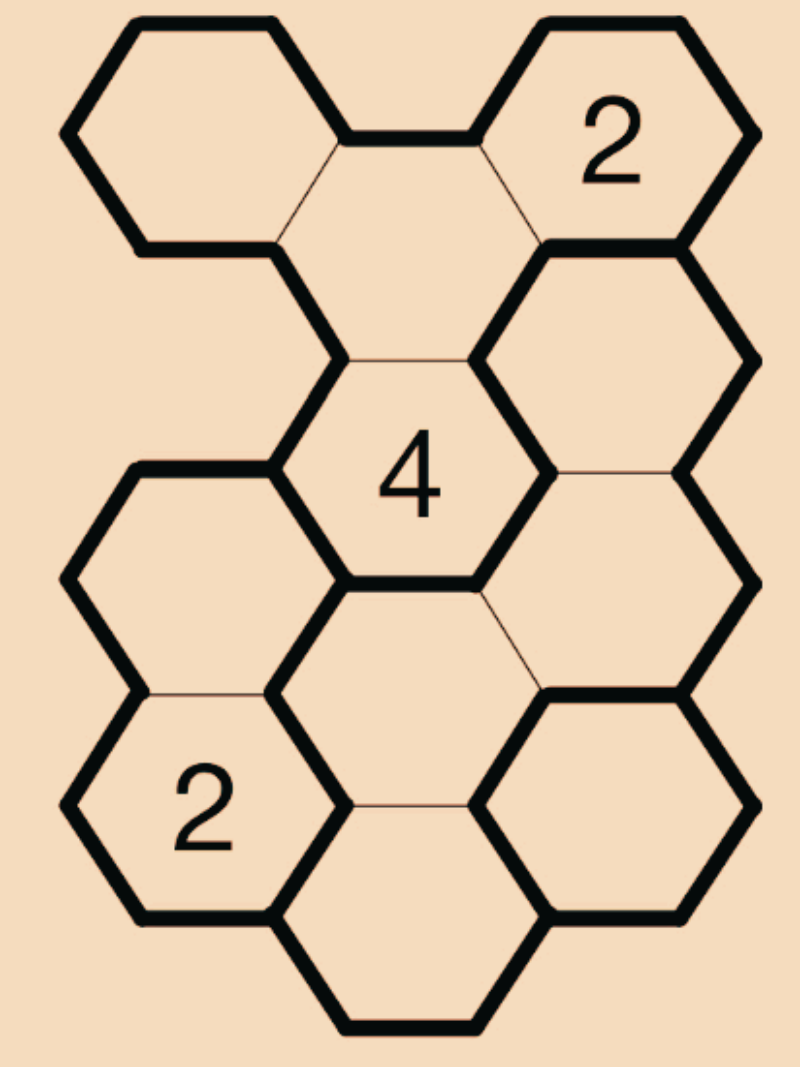
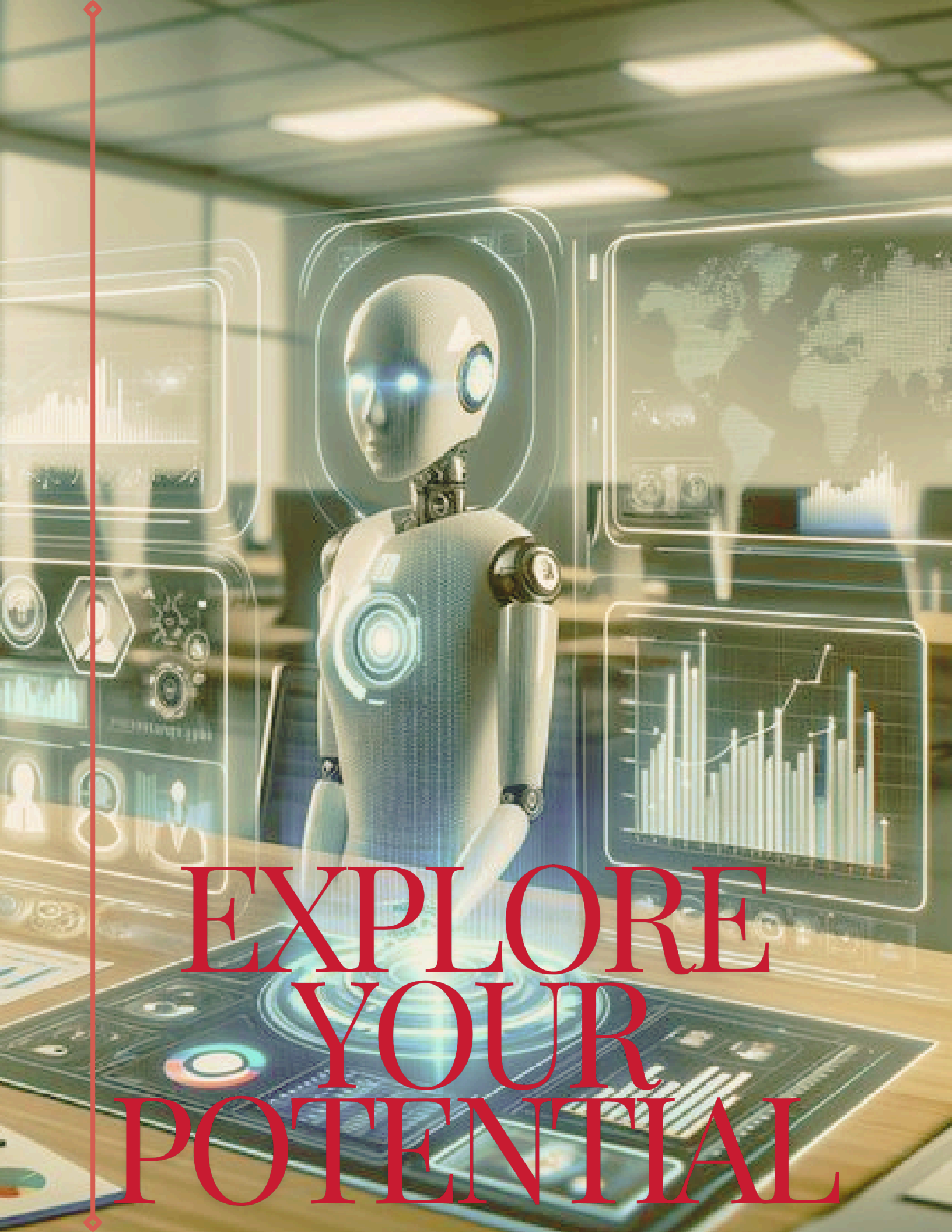
# GAME- Hive puzzle

A Cut Hive puzzle is made up of a hexagonal block called the "hive," with thicker lines used to indicate the various sections. A finished block needs to adhere to two rules.
1) Numbers from 1 to the total number of hexagons in the area must appear in each area.

For instance, the puzzle below has four hexagons in its uppermost section. The numbers one, two, three, and four must be put into these hexagons, without any repetitions. The numbers 1 and 2 must be placed in the region if it contains two hexagons, as the one bottom left below.

No number may be adjacent to another number along a common edge in any direction. Because there is a 4 in the centre of the grid below, none of the five hexagons surrounding it can also have a 4.

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