# *An overview of next generation technologies and its applications*

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***Abstract* – The term Next Generation Technology has been often used by IT enthusiasts. Many see next generation technologies as one of the solution vectors for the global challenges of the 21st century. However, a small research has shed light on this term and specified its characteristics and meaning of it. Next generation technologies are critical to solve large problems faced by this world. Therefore, this paper aims to highlight the benefits of Next Generation Technology. The primary aim of this research paper was to highlight the importanceofNextGenerationTechnology,tocreateawareness about its working principles and advantages and to inform its disadvantages. We have included the following concepts of the Next Generation Technology along with its implementing technology: Augmented Reality and Virtual Reality, Artificial Intelligence and Machine Learning, Autonomous Driving, Internet of Things, ModularSmartphones.**

***Keywords – next generation technology, augmented reality, virtual reality, artificial intelligence, machine learning, autonomous driving, internet of things, modular smartphones***

## I. INTRODUCTION.

NextGenerationTechnologiesaretechnologieswhichare perceived as capable of transforming the status quo. Next Generation Technology can be termed as "a radically innovative and relatively fast growing technology characterizedbythecertaindegreeofcoherenceexistingover thetimeandwiththepotentialtoexerciseasubstantialeffect on the socio-economic domain(s) which can be seen interms of the arrangement of actors, institutions and motif of interactions among these, along with the related knowledge production processes. Its most noteworthy impact, however, lies in future and thus the emergence phase is still in some measure undetermined and ambivalent." New technological fieldswouldleadtothetechnologicalconvergenceofvarious systems evolving towards similargoals

Convergence brings formerly various technologies such as data (and productivity instances) and video combined so that they can allot resources and communicate with each other, creating new efficiencies.

Next Generation Technologies are the ones technical innovations which depict continuous development within a fieldforcompetitiveadvantage.Theconvergingtechnologies represent formerly distinct fields which are moving towards stronger interconnection and identicalgoals.

## II. AUGMENTED REALITY AND VIRTUALREALITY.

### *A. AugmentedReality*

Augmented reality (AR) is a real-time view of the physicalenvironmentwhosecomponentsareaugmentedbya computer-generatedinputslikevideo,voiceorgraphics.This technology actually functions with the enhancement of one's current insight of reality. By using some advanced technologies, the information about the real world user becomes interactive and digitally manipulable. Information regarding the physical environment and its objects are overlaid on the real world. This sort of information can be virtualorreal.Bycontrast,VRtechnologysubstitutesthereal world with a simulatedworld.

It is the fusion of the real world and the digital world. Augmented Reality Devices do enhance and boost one's perception of reality through the incorporation of computer generated information and images into our senses [1]. These devices actually overlay data and rendered images onto physical objects and real life environments.

### *B. VirtualReality*

Virtualrealitycanbeseenasanimmersivemultimediaor also as computer-simulated reality. It replicates an environment which simulates physical environment in an imaginary world and thereby allowing the user to interact with the simulated world. Virtual reality is capable of

artificially creating sensory experiences that includes sight, touch, smell and hearing.

VirtualRealityisanartificialenvironmentthatcanmimic the physical features of the real world. This immersive medium has the power to create novel experiences that are unattainable anywhere else[2].

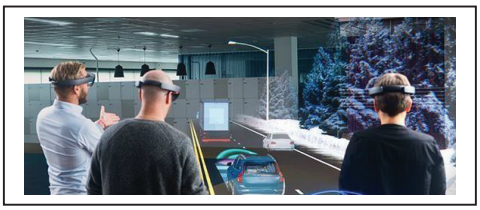
### C. WorkingPrinciple

Augmented Reality: The software must be able to derivethe real-world coordinates, which are independent fromcamera images. This process is known as image registrationand it has various methods for computer vision, generallyrelated to the video tracking. Many computer vision methodsregarding AR are inherited from visual odometry. Mostlythose methods are divided into two stages. The 1st stage hassome methods like blob detection, edge detection, cornerdetection, thresholding and various image processingmethods. The second stage functionally restores the realworld coordinate system from data obtained in the first stage.

Virtual Reality: Virtual Reality can be viewed with the help of special stereoscopic Virtual Reality displays, andfew of the simulations that include some additional sensory information and focus on the sound through speakers or headphones. The simulated environment is quite similar to therealworldinordertocreateareal-timeexperience.Afew of the advanced systems are now capable of including the tactile information which is known as force feedback[2].

### D. Applications

Augmented Reality: Microsoft HoloLens



HoloLens - Product of Microsoft

Microsoft HoloLens is an Augmented Reality device developedbyMicrosoft.Itrunsaself-containedWindows10 computer. It is part of the Windows Holographic AR Platform.Itcanbewornoveruser'seyes.UnlikeOculusRift and VR Devices, the eye-piece component of HoloLens is actually transparent and the headsets require neither PC nor smartphone. It is able to project high-definition virtual content over real-world objects[3].

Virtual Reality: PlayStation VR

PlayStation VR – Product of Sony

PlayStation VR is a head-mounted display being developed by Sony. It is also capable of rendering two separate displays simultaneously: one display for the headset and one completely different display for the television. The intention is preventing VR from invariably being a solitary experience[4].Ausercanplaygames,streamvideosandcan share gameplay. It uses special type of lenses called curved lenses which enlarges a 5.7-inch screen across user's field of vision.

### E. Disadvantages

Augmented Reality:

1) Privacy breach will become a major issue with today's information saturation levels. Interacting with a stranger or a group of people may reveal thoughts or other set information that usually come with an introduction, might cause an unwarranted violation ofprivacy.

2) Content may obscure or narrow a user's interests or tastes.

Virtual Reality:

1) Virtual reality faces many challenges like, motion sickness and other technical matters. A user may become bewildered in virtual environment, causing balance difficulties; computer latencies may affect the process of simulation, providing average end-user experience; the complex nature of VR displays and input systems like specialized gloves require specialized training in order to operate and navigate the original environment might prove vulnerable without any external sensory information [5].

## III. ARTIFICIAL INTELLIGENCE ANDMACHINE LEARNING.

### A. ArtificialIntelligence

Artificialintelligence(AI)referstotheintelligencewhich isexhibitedbymachinesorthesimilarsoftware.Itisalsothe nameofanacademicfieldthatstudieshowtocreatecomputer systems and computer software which are capable of demonstrating the intelligent behaviour. Major Artificial intelligenceresearchershavedefinedtheaias"thestudyand design of the intelligent agents" in which "the intelligent agents" is a system which is involved in perceiving of its environment and taking of the actions which maximize its chancesofsuccess.Itcanalsobedefinedas"theengineering and science of making the intelligentmachines".

### B. MachineLearning

Machinelearningisafieldofstudywhichgivescomputer systems the ability to grasp or absorb without any need of being externally programmed. Machine learning expands the study and building of the algorithms that learns from and makes predictions on data. It is closely associated with and generally overlapped with computational statistics; a discipline that focuses on making predictions throughthe use of computers. It has strong ties to mathematical optimization thatdeliverstheories,methodsandapplicationdomainstothe field.

*C. WorkingPrinciple*

Artificial Intelligence: There is no specific way in which AI works. Over the past few years, many of the different approaches of solving the wide range of problems have been conceivedbyArtificialIntelligenceresearchers.Forinstance, chess is now being played by computers. It works by scrutinizing many hundreds of chess board patterns, tocheck the result of executing some pre-defined moves. Another instance is expert systems, which solve the problems in the areas such as engineering and medicine by duplicating the problems solved by realhumans.

MachineLearning:Allofthemachinelearningalgorithms basically consists of the following threethings:

1) A set of possible models to lookassiduously.

2) A way to test whether a model isgood.

3) A clever way to find a really good model with only a fewtest.

There are two most popular methods of machine Learning:

1) Supervised learning: These algorithms are trained by using labelled examples. The aforementioned learning algorithm actually receives a set of inputs along with its corresponding correct outputs, and thus algorithm learns by comparing the actual output with the correct outputs to find errors. It will then modify the model by correcting it accordingly.

2) Unsupervised learning: Unsupervised Learning (U.L.) algorithms are used in contrast to the data which has no particular past labels. The system has not been given the "correctanswer."Thealgorithmmustidentifywhatexactlyis beingdisplayed.Theaimistoanalysethedataandfindsome partofthestructurewithinitself.Unsupervisedlearninggoes wellself-organizingmaps,k-meansclusteringofandsingular valuedecomposition.

*D. Applications*

ArtificialIntelligence:Vivisaglobalplatformthatallows developers to plug in and create an intelligent as well as conversational interface to anything. Viv is the simplest way for the users to interact by communicating with devices, services and things everywhere. Viv has the property of learning something new on a dailybasis.

Viv will also learn a huge portfolio of user's choices, credit-card numbers, addresses, and so on with user's consent. Hence Viv can answer some of the queries like "Please book an appointment for me with a French-communicating optometrist whose office falls on my way homefromwork,"and"Iwanttopickupadietcokecanfrom a general store on the way to my brother's house as it is recommended by my doctor as a supplement forwine."

Machine Learning: Cloud era is partnering with E8 Security to provide scalable and self-learning security analytics for detection and prioritizing of enterprise cyber security attacks. The E8 Security will fully automate the analysis of huge data with the help of machine learning and themulti-dimensionalalgorithmsforlatestsecurityanalytics. The primary feature of E8 Security's performance is the usage of advanced machine learning and multi-dimensional modellingtocontinuouslyadapttoupcomingbreakdowndata silos, threats, and integrate with the current technology investments inreal-time.

*E. Disadvantages*

Artificial Intelligence:

1) Excessive reliance on AI: If we depend too much on machines to do all things for us, we tend to become over dependent so that they acquire the potential to destroy our lives if anything goeswrong.

2) Human Touch: Machines will go on lacking theability to sympathise and empathise like human beings, and might act irrationally as anoutcome.

3) Inferior: Machines do perform almost every task marginally better than human beings in all possible ways. They will take up several jobs, which will then result in an increase in the percentage ofunemployment.

4) Misuse: This level oftechnologycould be misused and could lead to mass destruction, or they could perhaps even result in malfunction or can becorrupted.

Machine Learning:

1) Error prone: Usually impossible to get required accuracy.

2) The need of labelled data: Human resources should be used to manually classify the documents for the preparation of training set. Additionally, the number and the type of document that must be included in the training set is not straightforward.

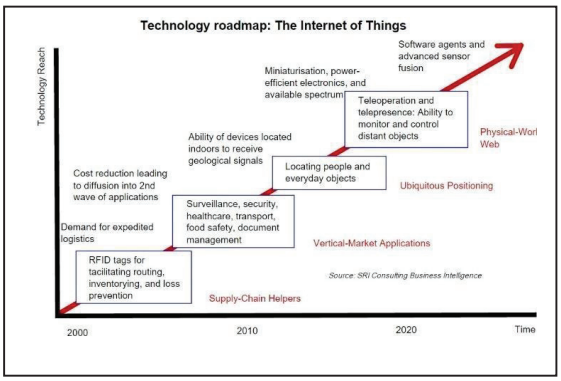
## IV. INTERNET OFTHINGS.

*A. Internet ofThings*

The Internet of Things is the network of physical object(s), device(s), vehicle(s), building(s) and other resources which are embedded with electronic gadgets, software, sensor(s), and internet connectivity that authorizes these objects for the collection and sharing of the data. The IoT actually permits objects that are to be sensed and controlled by the user throughout the current network infrastructure,creatingopportunitiesfortheintegrationofthe real world into computer systems, and thereby resulting in economic advantage, improved accuracy andefficiency.

*B. WorkingPrinciple*

The original idea is based on RFID-tags and thoseunique identification through EPC Code howbeit this has evolved into objects with a unique IP address or URI [6]. It mainly focuses on making all the required things addressable by the existing naming protocols. The objects don't converse themselves, but are referred to by some of the other agents, like powerful centralized servers working for theirowners.

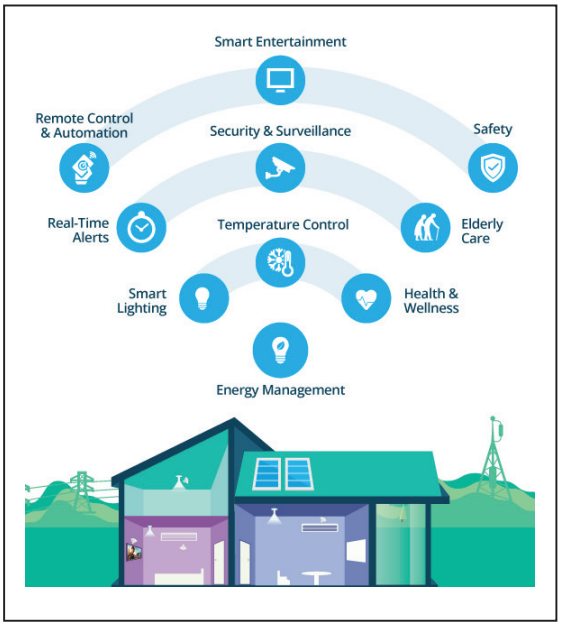



IoT Roadmap

The next generation of Internet-based applications use IPv6protocolwhichiscapableofinteractingwiththedevices attached to virtually any electronically compatible objectdue to the very large address space of the IPv6 protocol [6]. This systemcanbeusedtoidentifyobjectsinindustriesthatrange from aerospace to transportation logistics and fast moving consumer goods(FMCG).

*C. Applications*

RF Technology for Smart Homes:




Features of Smart Home

Smart Homes are founded on an integrated effort of applicationsthatenablehomeownerstoscrutinizeandcontrol a wide range of important applications namely improved energy efficiency, access control, home or office security, home surveillance and homecare.

Smart Home can be used for: Home monitoring and surveillance, Access control permission, Lighting control, Fire detection and control, Leak detection and corrective measures, Energy efficiency, Temperature monitoring and control, Family care.

*D. Disadvantages*

1) Threat to privacy and security: As all the household appliances,locks,industrialmachinery,publicsectorservices and many other devices all are connected with Internet and a huge amount of information is available over it. This information may be prone to attack by the black hat hackers. It would be very dangerous if there is a security breach and confidential information is accessed by unauthorized intruders.

2) Compatibility: As devices from various manufacturers are interconnected, the issue of compatibility in tagging and tracking comes up. Compatibility issues may result in people buying appliances from a group of manufacturers, leading to a monopoly based market.

## V. AUTONOMOUSDRIVING.

*A. AutonomousDriving*

An autonomous driving vehicle is a vehicle that has the ability to sense its environment and navigating without the interference of human beings. Autonomous driving vehicles have sensors that are designed to detect objects as far as few kilometres away in all different directions, including pedestrians, hikers, skaters, cyclists and vehicles or even fluttering shopping bags and rogue birds. The software gathers all the information for the car to safely navigate the road without getting tired or distracted.

*B. WorkingPrinciple*

Autonomous vehicles detect surroundings using methods like computer vision, radar, GPS and Odometry. Advanced systems understand and decipher sensory information in order to recognize convenient navigation paths and problems such as pot holes [7]. Autonomous cars do possess control systems which are capable of analysing sensory data so that one can easily differentiate between various cars on the road, amount of traffic, etc. which is very essential in planning a path to the required destination.

*C. Applications*

Google Self-Driving Car: It is an example of an autonomous car. The software installed in Google's car is namedGoogleChauffeur.TherangefinderisaVelodyne64-beam mounted on the top. The laser enables the vehicle for generating a 3D map of itssurroundings.

Google Self-Driving Car

Thenthecartakesthesemapsandmergesthemwithhigh-quality world maps, and thus creating different types of data model which allows it to drive autonomously. This system works with a high definition precise map of the area wherein the vehicle is expected to be used, predicting how high the traffic is, in addition to the on-board systems,some

procedural computation is carried out on remote computer farms.

*D. Disadvantages*

1) Safety concerns: The car relies chiefly on previously programmedrouteinformation,theydon'tnecessarilyfollow temporary traffic lights and, in some situations the car has problems in recognizing the objects that are harmless yet causing the vehicle to change the direction unnecessarily, suchaslightdebris.Additionally,thelidartechnologycannot identify some potholes or discern when a human, such as a cop, signals the car tostop.

2) Security: A car's computer could possibly be compromised,andalsoitssystemcouldbedamagedbetween cars by interrupting camera sensors, GPS jammers/spoofing [8].

## VI. MODULARSMARTPHONES.

*A. ModularSmartphone*

It is a smartphone which is a combination of various componentsofthephonethatcanbeindependentlyupgraded or replaced. It targets to lower repair costs, to increase usability reduce and electronicwaste.

The main component in the modular smartphone is the main board, to which the other components are connected. These are embedded in easily removable modules which can be swapped with each other as per requirement without the need to rework the soldering. Components are available at open-source hardware stores.

*B. WorkingPrinciple*

Modular Smartphones are built using the modules inserted into metal frames called "endos". The frame as anticipated will be the only component in a Smartphone. It behaves like a switch on the device network binding all the modules together. Frames have certain slots in front for the display and other modules. On the rear side, there are additionalslotsformodules.Thedatawithinthemodulescan be transferred at a rate of 10gigabits/sec per connection [9]. The2×2moduleshavetotaloftwoconnectionsandwillallow up to 20gigabits/second. Each slot on the frame shall accept anymoduleofthecorrectsize[9].Modulesaresecuredusing electro permanentmagnets.

*C. Applications*

Project Ara: Project Ara is the codename assigned to an initiative by Google which targets to develop an open hardware platform for the making of highly modular smartphones. It would enable users to swap out malfunctioning or the faulty modules or upgrade individual modules into the ones having the latest features as innovations emerge, providing longer life cycles for the smartphone,andpotentiallydecreasingthereuseofelectronic waste.


Prototype of Modular Smartphone by Project Ara

*D. Disadvantages*

1) Weight and dimensions of the phone could be a concern. Usage of too many modules will lead to a bulkier phone.

2) Baseframeischeaperbutothermodulesandpartsmay increase thecosting.

3) Compatibility may become a difficult problem. Combination of hardware components could be similar to solving a complex puzzle for the less knowledgeableuser.

4) Performance is still a big concern for Project Ara.This issuecouldbechallengingwhenthecustomizationofvarious components areintegrated.

## CONCLUSION

The Next Generation Technologies are currently in development stage. These technologies are very costly as of now and can't be afforded by masses. Moreover, it's applications in real life scenarios are very much limited to specific tasks. Public wide use of these technologies is still a distant dream and it remains to be seen when everyone would be using these technologies to make their daily lives easier than before.

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