

About Authors



Dr. D. Sivaganesan received BE degree in Computer Science Engineering in 1999, M.Tech degree in Information Technology in 2004 and Ph.D in Faculty of Information and Communication Engineering in the year 2013. He is currently working as an Professor in the Department of Computer Science and Engineering, PSG Institute of technology and Applied Research, Coimbatore. His research interest includes Mobile Computing, Cloud Computing, IoT, Simulation and Microprocessors Based Systems. He has published 25 technical papers in International, National Conferences and Journals.



Reji R completed Ph. D. in Computer Science and Engineering from Mahatma Gandhi University, Kerala. He is currently working at the Department of Computer Science and Engineering, Carmel College of Engineering and Technology, Kerala. He has published more than 25 Research papers in various journals. He has edited 2 books and has given many invited talks in various conferences and FDPs. His research interests include HCI and Block chain.



Dr. Murugananth Gopal Raj graduated in Electrical and Electronics Engineering from PSNA College of Engineering and Technology, Dindigul, Tamil Nadu, a Master's Degree in Power Electronics & Drives from Government College of Technology, Coimbatore, Tamil Nadu, and a Ph.D. under the Faculty of Electrical Engineering, Anna University, Chennai, Tamil Nadu. He has more than two decades of teaching experience. At present, he is working as a Professor and Head of the Department of Electrical and Electronics Engineering at Ahalia School of Engineering and Technology, Palakkad, Kerala, since June 2014. He received 'GREEN9 ENSAV BEST ADVISOR AWARD 2020' from The Institution of Green Engineers, SDG Conclave 2020, "Lead Auditor in Energy and Environment MANAGEMENT

Audits," from Nature Science Foundation, Coimbatore, 'Best Teacher Award' from Technical Research Publications TRP AWARDS 2020 and 'PERASIRIYAR SIGARAM VIRUDHU - 2020' from Marutham Ilakiya Kaiyu Maiyam, Marutham Educational Trust, Kumbakonam, He has guided more than 50 B.E/B.Tech. Graduates, 24 M.E/M.Tech. Graduates and 7 Ph.D. scholars. He has more than 25 publications in reputed International and National journals with SCI, SCIE, and Scopus indexes. In the Indian Journal of Patent, he has published seven patents and received 1 Innovation Grant Patent, Australian Patent. He has authored a chapter in various books and served as an associate editor for various international conferences. So far, he has co-authored five books. He is the Coordinator for ISO 9000:2015, NAAC and NBA accreditation process, and Centre for Energy & Environment, Ahalia Group of Educational Institutions. He is a Certified Home Energy Assessor and Empaneled Member, Energy Management Centre, Trivandrum, Government of Kerala and NSF certified Lead Energy Auditor.



Dr. SUJITH S, graduated in Electrical and Electronics Engineering from Calicut University and MTech in Power Electronics from NIT Calicut and PhD from Vellore Institute of Technology (VIT), Vellore. He has more than two decades of experience in teaching and currently working as Professor at Department of Electrical and Electronics, NSS College of Engineering, Palakkad (Kerala). He has publications in several Journals of National and International stature. He served as member of board of studies as well as Board of faculty in Calicut university for several years. He has taken lead roles in various functionaries of Kerala Technological University like member of Exam monitoring committee, Camp officer etc. He has organized several technical events for the benefit of students/teachers in

Engineering field including AICTE sponsored National Conferences and Faculty development programs/Workshops sponsored by AICTE/ professional bodies.



UNDERSTANDING BLOCKCHAIN TECHNOLOGY

Dr. D. Sivaganesan
Dr. Reji Ravi
Dr. Murugananth Gopal Raj
Dr. Sujith S



Emerging Technologies in Engineering Research



Chapter 7: Smart Electrical Grids

Dr. Murugananth Gopal Raj

Dr. S. Arul Kumar

Dr. G. Irusapparajan

Dr. K. Karthikeyan

Technical Research Publications

ISBN: 978-93-5419-211-1 (Online)

SMART ELECTRICAL GRIDS

Dr Muruganath Gopal Raj¹, Dr S Arul Kumar², Dr G Irusapparajan³, Dr K Karthikeyan⁴

¹Professor & Head, Department of Electrical and Electronics Engineering,
Ahalia School of Engineering and Technology, Palakkad, Kerala, India.

²Professor, Department of Electrical and Electronics Engineering, Bonam Venkata Chalamayya
Institute of Technology & Science, Andhra Pradesh, India.

³Professor, Department of Electrical and Electronics Engineering, Mailam Engineering College,
Tamilnadu, India.

⁴Associate Professor, Department of Electrical and Electronics Engineering,
St.Mother Theresa Engineering College, Tuticorin, India.

Abstract: Smart grids are a developed grid systems which oversees power request in a manageable, dependable and financial way, based on cutting edge infrastructure and tuned to encourage the incorporation of all included. In the realm of the Smart Grid, customers and service organizations the same have instruments to oversee, screen and react to energy issues. The progression of power from utility to buyer turns into a two-way discussion. Smart grids will give greater power to fulfill rising need, increment dependability and nature of intensity supplies, increment energy productivity, can incorporate carbon free fuel sources into power networks.

Keywords: Smart Grid, Modeling, Security Challenges and Features.

I. INTRODUCTION

A Smart Grid (SG), likewise named smart electrical/power grids, intelligent grids, intelligrids, future grids, intergrids, or intragrids, are an improvement of the twentieth century power grid. The customary force grid is commonly utilized for conveying power as of a couple of focal generator toward an enormous amount of clients otherwise consumers. Interestingly, the Smart Grid utilizes two path streams of power as well as data for making a robotized also appropriated progressed energy conveyance networks.

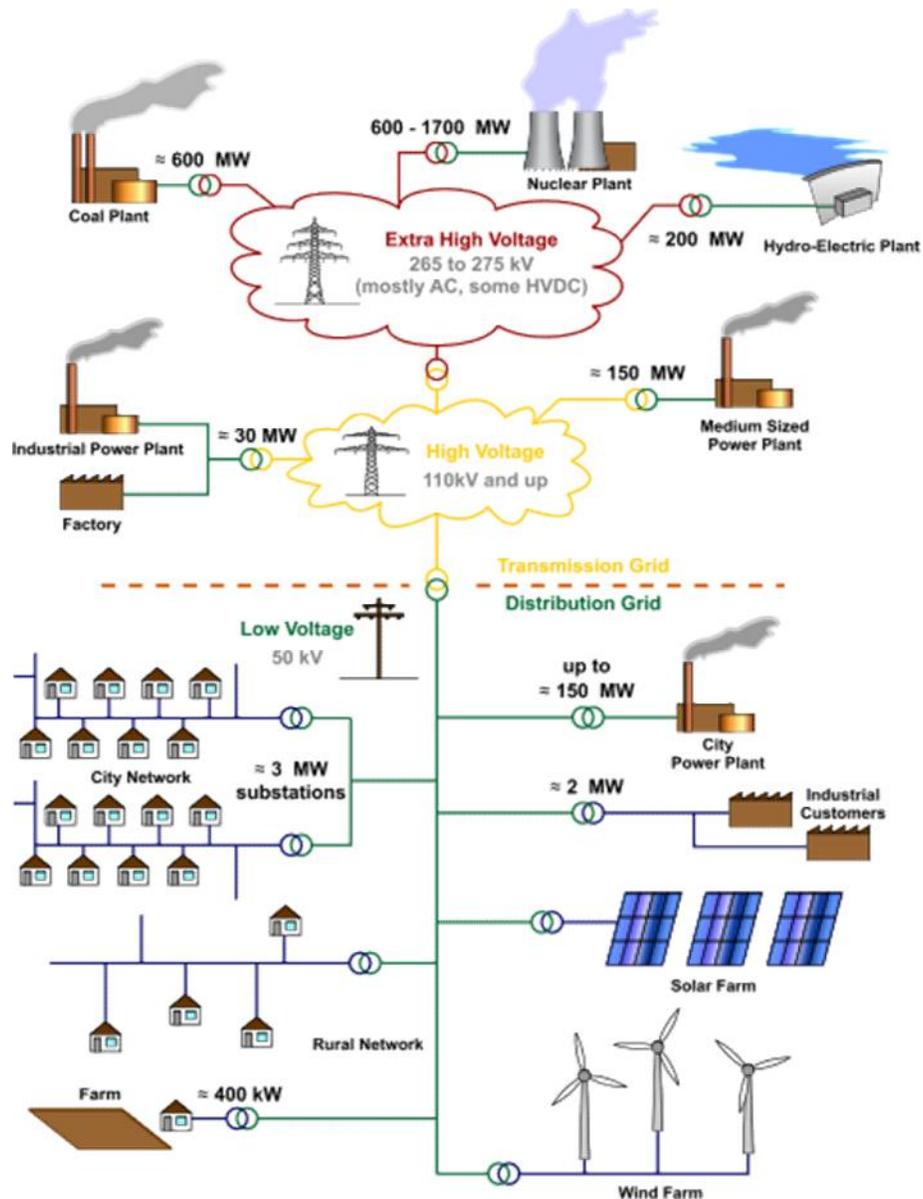


Figure.1: Smart Electrical Grid System

With the help of existing year's information innovations, the smart grids are equipped to convey power into additional effective manners as well as react toward wide extending condition as well as occasion. Broadly articulated, the smart grid can receive occurrences which happens anywhere within the grids, for example, control period, broadcast, circulation, and consumption, furthermore receive the linking procedures. For instance, when an average voltage transformer

disenchantment occurrence takes place into the dispersion grid, the smart grid might naturally alter the force streams also recuperate the force transportation administration.

To a greater extent explicitly, the smart grid is observed like an electrical system which utilizes information, two-way, digital secured communication progress, furthermore computable approaching into an integrated manner across control period, broadcast, substation, dispersions as well as consumption for accomplishing a system which has been spotless, protected, secured, dependable, stronger, effective, as well as sustainable. These portrayals cover the entire collection of the energy system as of the age toward the final intentions of consumption of the power [1]. A perfect smart grid has been a dream. This has a liberated reconciliation of correlative part, subsystem, capacity, as well as administration below the unavoidable power of profoundly astute management as well as power systems. Known the tremendous outlook of the smart grid research, various scientists might communicate various visions of the smart grid due to different concentrations also viewpoint. Taking into account these organizations, herein, let's study three significant systems into smart grid as of an expert's viewpoint:

Smart Infrastructure System: The smart infrastructure systems are the energy, information, also communication infrastructure fundamental of the smart grid which upholds 1) improved control period, transportation, as well as consumption; 2) developed information assessing, observing, as well as management; and 3) progressed communication innovations.

Smart Management System: The smart management systems are the subsystems within smart grid which provides developed management as well as power management.

Smart Protection System: The smart protection systems are the subsystems into smart grid which provides developed grid firm standard examination, disenchantment protection, furthermore safety as well as secured protection management.

II. SMART GRID MODELLING

A wide range of ideas have been utilized to demonstrate keen force grids. They are commonly concentrated inside the structure of complex systems. In an ongoing meeting to generate new

ideas, the force grid was considered inside the setting of ideal control, environment, human perception, smooth elements, data hypothesis, microphysics of mists, and numerous others. Here is a choice of the sorts of investigations that have showed up as of late.

Bio-Systems: Power grid is identified with difficult natural system into numerous different settings. During some investigation, power grid was contrasted with the dolphin's informal community [2]. Such animals smooth out or strengthen communication if there should arise an occurrence of a bizarre circumstance. The intercommunication which empowers themselves for enduring is profoundly intricate.

Random Fuse Networks: Into permeation hypothesis, irregular circuit network is contemplated. The existing thickness may be excessively lower into certain regions, also excessively solid in others. The examination can hence be utilized to streamline possible issues in the network. For example, rapid PC examination can foresee blown circuits and right for them, or investigate designs that may prompt a force blackout [3]. It is hard for people to foresee the drawn out examples into difficult network, thus circuit otherwise diode's network is utilized.

Smart Grid Communication Network: Simulator is utilized for recreating/copying network's communication impacts. These ordinarily include creating a laboratory by the SG gadgets, application and so forth through the virtualized networks been given with the network's test system [4].

Neural Networks: Neural network (NN) is believed to have control grid administration too. Electrical force system is arranged into various manners: non straight, active, distinct, otherwise arbitrary. Fake Neural Network (ANN) endeavors toward settle the majority troublesome of such issues, the non direct issues.

III. SECURITY CHALLENGES

A smart grid is an enormous scope system which extends since a force age workplace toward each particular force overwhelming gadgets, such as, house apparatus, personal computer, as well as telephones. Such huge scope character enlarged the possible results of far off activity of

intensity management as well as appropriate system. By energy being a superior quality, assuring safety beside robbery, misuse, as well as malevolent work outs within a smart grid has been a major issue.

The complexities of assuring network protection within a smart grid have been different in character due to the mixed variety of the components as well as the configurations through which smart grids have been conveyed. Transmitting a smart grid with no firm as well as industrious safety measure permits developed digital attacks remains undetected, that can inevitably bargain the entire system [5]. Lacking safety measure could likewise bargain the strength of the grids through presenting this to, for instance, effectiveness extortion, thrashing of private client data as well as power-utilization information [6].

The digital protection goals are arranged to accompany 3 classes [7].

Honesty: Protecting against the unapproved alteration or annihilation of data. Unapproved data access opens the entryway for misusing of data, prompting mismanagement otherwise misuse of intensity.

Secrecy: Protecting safety as well as restricted information by approved constraints on data access and divulgence.

Accessibility: Ensuring convenient and solid admittance toward information also administration. It's been undermined through disturbance of admittance for information which subverts the force transference.

Accessibility as well as honesty has been the major significant safety destinations in the SG as of the viewpoint of system firm feature. In any case, because of the systems collaborations through customers, the importance of classifications are additionally developing into these two-manner data communication system which interrelates the entire system together with meter, gatherers, communications network, also efficacy server ranch [5].

Smart grid security component ought to be upheld at a few levels together with physical as well as intelligent layer [5]. Truly, SG system as well as part should be made sure about as of hurt,

treating, burglary, defacing, and damage. Instances of physical layer's safety incorporate establishment of barrier, visual reconnaissance, as well as ready systems. Safety within the sensible layers manages ensuring the advanced information. Into [5], a point by point conversation on sensible layer's safety instruments is introduced; a couple of this is featured underneath.

- **Encryption:** information encoding within SG, as of meters toward service focus, has been a valuable apparatus for forestalling sneaking around, subsequently shielding the classification of data. Solid however dynamic calculation is utilized; nonetheless, the entire SG gadgets, such as, meter, gatherer, processor, as well as switch, is authorized by encrypting usage ability.
- **Authentication:** This has the method toward validating such as a customer otherwise substances are, for sure, equivalent to been assured. SG application should consist of solid verification abilities, for recognizing as well as discharge unauthorized association among its fragments, for instance, meter and the service interface.
- **Application Security Controls:** Smart meter application ought to be planned as well as coded properly so that cybercriminals can't get to a meter to mount support flood attacks otherwise for installing an attack. Data authorization has been a scenario of methods which is been utilized.
- **Security Patches:** It could shield an application from known dangers; consequently, codes ought to be remained by the most recent safety patch.
- **Malware Removal:** Use of anti-virus as well as anti-spyware programming all with the smart grid application could assist with distinguishing as well as eliminating malwares as of the system.

Assuring digitalized protection into SG requires nonstop monitoring with the goal where several possible assaults are recognized within occasion furthermore appropriate shifts are done quickly. In addition, verifying several SG boundaries could assist distinguishing some dubious otherwise strange actions. Moreover, comprising fast rebuilding arrangements are also significant.

IV. SMART GRID FEATURES

SG signifies the complete set-up of flow as well as projected responses toward the complexities of control flexibly. In view of the differing scope of variables, it has various competing systematic classifications furthermore no indulgence to complete definitions. All things considered, one potential order is given here.

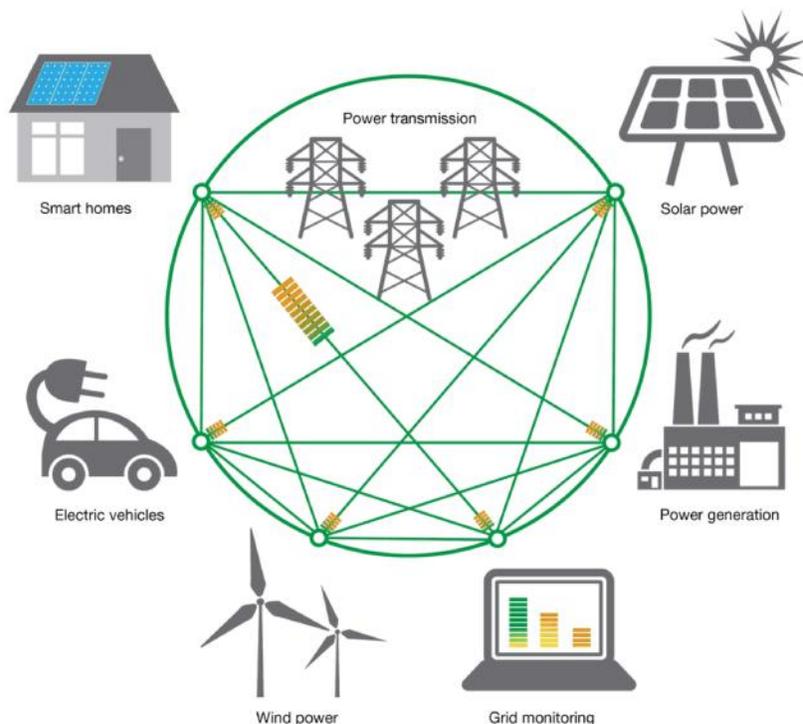


Figure.2: Features of Smart Electrical Grid

Reliability: SG utilizes improvements, such as, state assessment [8], which improves flaw recognition as well as permits its own improving of the network exclusive of the intercession of specialists. It guarantees additional firm gracefully of authority, as well as reduced limitation toward catastrophic events otherwise assaults. Albeit various courses have been promoted like an element of the SG, the older grids additionally emphasized several lessons. Starting electric wires within the grid had been manufactured using spiral models, afterward accessibility had been guaranteed through numerous lessons, proposed like a network configuration. In any case, it did

several other issues: when the existing streams otherwise associated impact upon the network beat the restrictions of a particular network element, this can fizzle, furthermore the existing is moved toward further network elements, so that during the long-term might flop as well, causing a domino impacts. Observe power shutdown. A method toward forestall which load sheds through engineered power outages otherwise voltage decreases.

Adaptability in Network Topology: Next-age broadcast as well as conveyance infrastructure is healthier organized for dealing with possible bi-directional energy stream, considering disseminated age, such as, as of photovoltaic board upon construction rooftop, yet as well charge to/from the battery of electrical vehicles, wind-turbine, siphoned hydro-electrical force, the utilization of power devices, as well as several basis. Exemplary grid has been proposed on behalf of single direction streams of power, however as it was with the aim of a neighborhood sub network produces additional force compared to its disbursing, the converse streams could increase comfort as well as firm feature concerns. A SG intends toward deal with such circumstances [9].

Effectiveness: Numerous commitments to in general development of the productivity of power infrastructures have been foreseen as of the organization of SG innovation, specifically together with request area administration, for instance killing forced air systems in transient spike into power value, decreasing the voltages while conceivable upon circulation line by Voltage/VAR Optimization (VVO), wiping away truck-shifts of meter peruse, furthermore lessening truck-shifts through improved collapse management using data as of Advanced Metering Infrastructure systems. The common impacts are less repetition within broadcast as well as appropriation line, also further notable use of generator, urging low power cost.

Manageability: The improved flexibility of the smart grid certifies further significant infiltration of profoundly factors sustainable power source, such as, sun oriented force as well as wind power, yet exclusive of the extension of energy accumulation. Existing network infrastructure isn't worked to consider many disseminated input concentrates, also normally despite of whether several inputs are allowed on the nearby (scattering) levels, the broadcast-level infrastructure could not oblige this. Rapid changes during disseminated age, such as, due to overcasting otherwise windy

climates, present noteworthy complexities toward control engineer and they should warranty firm force level by fluctuating the yields of the additional manageable generator, as, gas-turbine also hydro-electric generator. Smart grid innovations have important criteria to several of inexhaustible powers upon the grids consequently. It's been likewise upholding vehicle-to-grid.

Market- empowering: The SG considers organized communications among providers (its power cost) also buyers (its readiness to-compensate), as well as allows equally the providers plus the purchasers should further adaptable along with complex during its functional procedures. Just the basic burdens should address the pinnacle energy costs, and purchasers will have the option for further vital into while it uses power. Generator through more prominent adaptability would have the option for selling power deliberately to greatest benefit, while unbendable generators, for example, foundation-load steam-turbine as well as wind-turbine would get a changing levy dependent fair and square of interest and the status of different generators right now working. The general impacts are a sign which grants power productivity as well as power utilization which has been delicate toward the instant-shifting constraints of the flexibly. On the homegrown levels, apparatuses through levels of power stockpiling otherwise warm gathering, (for example, fridges, heat bank, as well as warmth siphons) are all around put toward 'plays' the advertise as well as aim to limit power rate through adjusting request toward the cheaper power uphold times. It's an expansion of the dual levy power estimating referenced previously.

V. CONCLUSION

Herein, numerous aspects of the smart electrical grid are conversed so as to incorporate modeling, safety challenges as well as features of novel grid element. The SG has a huge, interconnect systems through numerous novel as well as rising parts also application, that needs a careful examination upon the interoperable concerns too. Plainly, various specialized difficulties as well as concerns related to successful as well as safe communications also data handling have to be settled prior to understanding the idea of a smart power grids.

REFERENCES

1. H. Gharavi and R. Ghafurian. Smart grid: The electric energy system of the future. Proceedings of the IEEE, 99(6):917 – 921, 2011.
2. David Lusseau (2003). "The emergent properties of a dolphin social network". Proceedings of the Royal Society of London B. 270 (Suppl 2): S186–S188.
3. Olaf Stenull; Hans-Karl Janssen (2001). "Nonlinear random resistor diode networks and fractal dimensions of directed percolation clusters". Phys. Rev. E. 64 (1): 016135.
4. Montazerolghaem, A.; Yaghmaee, M. H.; Leon-Garcia, A. (2017). "OpenAMI: Software-Defined AMI Load Balancing". IEEE Internet of Things Journal. PP (99): 206–218.
5. E. Hayden, "There is No SMART in Smart Grid without secure and reliable communications," Tech. Rep., Varizon.
6. X. Fan and G. Gong, "Security challenges in smart-grid metering and control systems," Technology Innovation Management Review. In press.
7. Guidelines for Smart Grid Cyber Security, The Smart Grid Inter- operability Panel: Cyber Security Working Group, Gaithers- burg, Md, USA, 2010.
8. Yih-Fang Huang; Werner, S.; Jing Huang; Kashyap, N.; Gupta, V., "State Estimation in Electric Power Grids: Meeting New Challenges Presented by the Requirements of the Future Grid," Signal Processing Magazine, IEEE , vol.29, no.5, pp.33,43, Sept. 2012.
9. Berger, Lars T.; Iniewski, Krzysztof, eds. (April 2012). Smart Grid - Applications, Communications and Security. John Wiley and Sons. ISBN 978-1-1180-0439-5.

Emerging Technologies in Engineering Research



Chapter 11: Deep Learning

Dr. Murugananth Gopal Raj

R. Kanimozhi

Dr. A. Anushya

Dr. Amanpreet Kaur

Technical Research Publications

ISBN: 978-93-5419-211-1 (Online)

DEEP LEARNING

Dr Murugananth Gopal Raj¹, R Kanimozhi², Dr A Anushya³, Dr Amanpreet Kaur⁴

¹Professor & Head, Department of Electrical and Electronics Engineering,
Ahalia School of Engineering and Technology, Palakkad, Kerala, India.

²Associate Professor, Department of Electronics and Communication Engineering,
Faculty of Engineering and Technology, Annamalai University,
Chidambaram, Tamilnadu, India.

³Assistant Professor, Department of Computer Science, St. Jerome's College,
Nagercoil, Tamilnadu, India.

⁴Associate Professor, University Institute of Engineering, Chandigarh University,
Mohali, Pubjab, India.

Abstract: A Deep Learning has been a category of machine learning (ML) that accomplishes strongly preferable on amorphous information. Deep learning strategies have been outflanking existing ML procedures. This empowers computation model for gaining includes continuously as of information by different stages. The prominence of deep learning enhanced since the measure of information accessible expanded just as the headway of equipment that gives incredible PCs. This chapter involves the development of deep learning, different ways to deal with deep learning, designs of deep learning, strategies, and applications.

Keywords: Deep Learning, Machine Learning, Artificial Intelligence and Neural Networks.

I. INTRODUCTION

Deep learning as well recognized like deep structured learning; it has been important for a more extensive group of ML techniques dependent upon artificial neural networks (ANN) with portrayal learnings. Learnings are administered, semi-administered otherwise unsubstantiated [1-3]. Deep learning has been a class of ML calculations which uses numerous coats toward reasonably separate more elevated level highlights as of the rudimentary data. For example, during

image preparing, junior layer might identify boundaries, whereas higher layer might differentiate the concepts related toward a humanoid, e.g., numbers otherwise letters otherwise face [4].

Mainly present-day deep learning model depend upon ANNs, obviously, Convolutional Neural Networks (CNN)s, while it could similarly integrate propositional calculations otherwise inactive factors collected layer wise into deep propagative model, e.g., the hub within deep conviction networks also deep Boltzmann machine [5].

During deep learning, every level figures out the way to alter their data to a marginally additional active also complex representation. During a image acknowledgment applications, the rudimentary data is a network of pixel; the primary reliable layers might digest the pixel also encrypt boundaries; the subsequent layers might build also encrypt courses of action beyond boundaries; the 3rd layers might encrypt a nose as well as eyes; and the 4th layers might notice such as the image have a face. Critically, a deep learning cycle could understand that highpoints toward preferably allocate whichever levels all alone.

The word "deep" within "deep learning" refers towards the amount of layer whereby the data has been altered. Especially, deep learning framework has a generous credit assignment path (CAP) perspicacity. The credit assignment path has been the shackle of variations as of contribution towards yield. Covers portray perhaps fundamental association among info as well as yield. Aimed at a feedforward neural network, the perceptiveness of the credit assignment path has been a network also the amount of covered layer as well as one (since the yield layers are furthermore defined). Towards repetitive neural network, where a sign might engender by a layer above once, the credit assignment path profundity has been conceivably boundless [2]. Not one all-around endless supply of profundity partitions narrow learnings as of deep learning, though furthestmost scientists agree such as deep learning comprises credit assignment path profundity higher compared to two. Credit assignment path of profundity two is established to be a widespread approximator since this could replicate somewhat capacity. Past that, further layers do not augment towards the capacity approximator capacity of the network. Deep models ($CAP > 2$)

could separate preferred highpoints on narrow model also hence, further layer helps during learning the highlights effectively.

II. EVOLUTION & HISTORY

Deep learning has been a subcategory of machine learning, which utilizes calculations. An infant that can't talk in the absolute starting point inside a couple of eons, this gains as of the individuals everywhere. Now originates the function of the neural network that has like networks within the cerebrum [6].

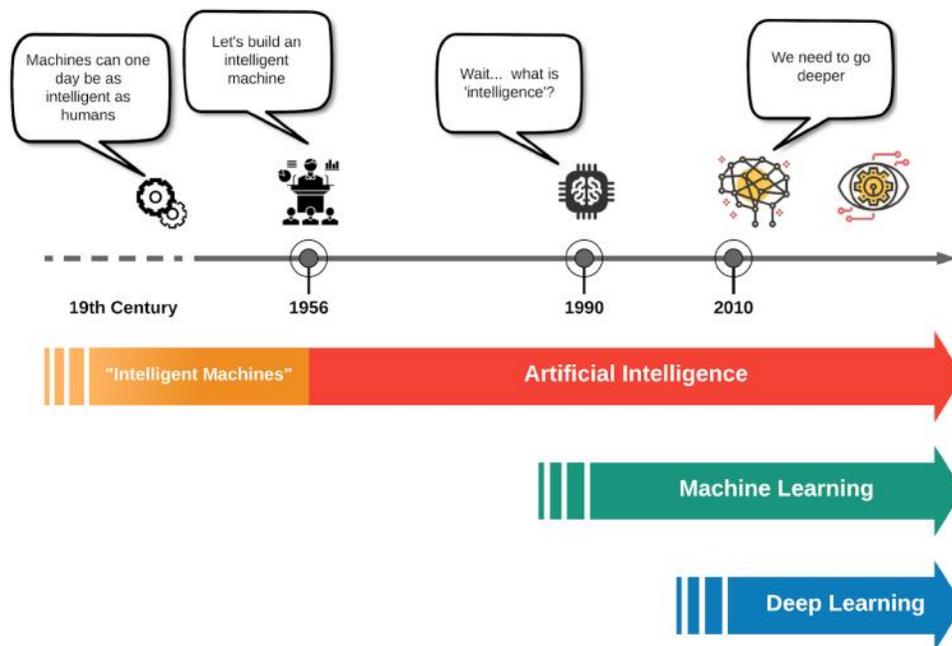


Figure.1: Deep Learning – A History

The term deep learning had been initially utilized whereas discussing ANNs by Igor Aizenberg also partners within otherwise round 2000. Deep learning has been a subcategory which utilizes different levels towards continuously separate more significant level highlights from the crude information. for instance, picture handling higher the layer expanded the idea of distinguishing proofs are applicable towards humanoid-like faces else letters bring down the layer this may recognize the boundaries as it were.

Artificial Intelligence (AI) is a subcategory of Machine learning (ML) also it holds additional subsets and it is Deep learning (DL). DL assumes a part within ML through the neurons existing into our cerebrums. Such neuron is sorted out as layers. Various layer performs various types of changes on its information sources. An immense assortment of neural network task incorporates discourse acknowledgment, informal communication, and so forth DL had been created towards further explicit levels through the inclusion of AI as well as ML [6].

History:

This is the furthestmost significant advancement into the realm of AI at the present time. Be that as it may, rather than attempting to get a handle on the subtleties of the field which could stretch this article excessively a lot. We should simply investigate a portion of the significant improvements throughout the entire existence of deep learning.

Regardless of the reality where the study of the humanoid mind has a huge number of eons old. The initial move to neural networks occurred during 1943.

In 1943: Once Warren McCulloch, a neurophysiologist, also a youthful mathematician, Walter Pitts, composed an article upon the way neuron may function. It displayed a basic neural network through electric circuit.

In 1958: Frank Rosenblatt makes the discernment, a calculation of design acknowledgment dependent upon a dual-layer PC neural network utilizing straightforward expansion also deduction. The observation figures a subjective entirety of the data sources, deducts a limit, also permits one of two potential qualities available as the outcome.

In 1980: Kunihiko Fukushima suggested the Neocognitron that has been progressive, multifaceted ANN. This is utilized in penmanship acknowledgment also further example acknowledgment issues.

In the 1980s-1990s: Deep Learning had been acquainted with the ML network through Rina Dechter during 1986. Yann LeCun's designed the machines which can peruse manually written numbers. These creations cut down underneath the more extensive biosphere's radar. Whereas the

calculation functioned also this involved preparing for 3 days. Now, once the subsequent Artificial Intelligence winter started, that additionally affected examination of neural networks also Deep Learning. Different excessively idealistic people had overstated the "quick" capability of Artificial Intelligence, breaking desires, and enraging financial specialists. Fortunately, a few people kept on chipping away at Artificial Intelligence also Deep Learning, besides several critical developments had been completed. During 1995, Dana Cortes as well as Vladimir Vapnik built up the help vector machines.

Sepp Hochreiter also Jürgen Schmidhuber distribute an achievement article upon "Long Short-Term Memory" (LSTM). This is a kind of Recurrent Neural Network engineering which would proceed towards change DL for a long time to arise.

In 2006: Geoffrey Hinton, Ruslan Salakhutdinov, Osindero, also the inside and out distributed the article. A quick learning calculation of deep conviction nets where it loaded various information bases collected into layer also termed it as Deep Belief Networks. The preparation cycle has been significantly further proficient towards a lot of information.

In 2008: Andrew NG's gathering next to Stanford began upholding aimed at the utilization of Graphics Processing Units. Along these lines, such as it could prepare Deep Neural Network toward accelerate the preparation timing through numerous folds. It might acquire common sense the area of Deep Learning to prepare upon a tremendous capacity of information productively.

In 2009: Discovering adequate named information is consistently been a test of the Deep Learning people group. During 2009 Fei-Fei Li, an Artificial Intelligence educator on Stanford dispatched ImageNet, collected an unrestricted information base of in excess of 14 million marked pictures. This will fill in like a standard towards the deep learning analysts where one might take an interest in ImageNet rivalries consistently.

In 2012: AlexNet, a Graphics Processing Unit executed the Convolutional Neural Network models planned by Alex Krizhevsky. AlexNet won Imagenet's picture grouping challenge by an exactness of 84%. This has been an immense hop upon 75% precision as prior model had accomplished. This success causes another deep learning blast worldwide.

In 2014: Ian Goodfellow made GAN otherwise called Generative Adversarial Neural Network which opens a totally different entryway of use of deep learning into style, workmanship, technology, and so on.

In 2016: Deepmind's deep fortification learning models blows the humanoid boss into the unpredictable round of Go. The games are substantially further unpredictable compared to chess. Subsequently, these accomplishments catch the creative mind of everybody. Likewise, this yields the guarantee of deep learning towards an unheard-of level.

In 2019: Yoshua Bengio, Geoffrey Hinton, as well as Yann LeCun gained Turing Award 2018. They had tremendously added towards progressions into the region of DL as well as AI. It had been an extremely important occasion for the individuals who had worked perseveringly on neural networks.

III. DEEP LEARNING APPROACHES

Deep neural networks have been fruitful for supervised learnings, unsupervised learnings, Reinforcement learnings, just like hybrid learnings [7].

3.1 Supervised Learning: Into supervised learnings, the information factors spoke to since X is planned for outcome factors spoke to since Y through utilizing a calculation toward get familiar with the planning capacity f.

$$Y = f(X) \quad (1)$$

The point of the learning calculation has surmised the planning capacity toward foresee the yield (Y) to another info (X). The mistake since the forecasts completed through preparing is utilized for addressing the yield.

3.2 Unsupervised Learning: Into unsupervised learnings, it has the information just as well as not any relating out-put toward plan. These learning plans toward find out around information through demonstrating the dissemination within information. Calculations could have the option for finding the energizing assembly existing into the information. Bunching issues and affiliation issues utilize

unsupervised learning and these calculations, for example, K-implies calculation is utilized in bunching issues [8], Apriori calculation is utilized in affiliation issues [9].

3.3 Reinforcement Learning: Reinforcement learning utilizes an arrangement of remuneration also discipline towards preparing the calculation. Herein, the calculation otherwise a specialist gains as of their current circumstance. The operator gets prizes for right execution and punishment for wrong execution. For instance, think about the instance of a self-driving vehicle, the specialist receives a compensation to drive securely for objective also punishment to go rough terrain. Additionally, on account of a plug-in to play chess, the prize stage might be dominating the match as well as the punishment for being checkmated. The operator attempts toward amplify the rewards also limits the punishment. During fortification learning, the calculation isn't advised how to play out the learning; be that as it may, it works through the issue all alone [10].

3.4 Hybrid Learning: This alludes toward models which utilizes propagative (unsupervised) just like discriminatory (supervised) segments. The blend of various structures is utilized for planning a cross breed deep neural network. It is utilized towards activity acknowledgment of people utilizing activity bank includes also relied upon for delivering strongly preferable outcomes [11].

IV. DEEP LEARNING METHODS

Few of the ground-breaking strategies which is useful for deep learning calculation for diminishing the preparation time also for improving the models have been talked about into the accompanying area.

Back Propagation: While taking care of an advancement issue utilizing a slope-based strategy, back spread can be utilized to figure the angle of the capacity for every cycle [12].

Stochastic Gradient Descent: By means of the curved capacity within slope plunge calculations guarantees finding an ideal least without getting caught in a nearby least. Contingent on the estimations of the capacity as well as learning rates else stepping sizes, this might show up on the ideal incentive into various ways also habits [13].

Learning Rate Decay: Altering the learning rates expand the exhibition as well as lessens the preparation season of stochastic inclination plummet calculations. The general utilized strategy should decrease the learning rates step by step, where one could roll out enormous improvements toward the start and afterward diminish the learning rate steadily in the preparation cycle. This permit calibrating the loads into the advanced phases.

Dropout: The overfit issue into deep NN is tended to utilizing the drop out procedure. These techniques are executed through haphazardly falling unit also its associations in preparing [14]. Dropout provides a successful regulation strategy for diminishing the overfit also improves speculation blunder. This provides a better exhibition upon supervised learning errands into Personal Computer visualization, computation science, record order, and discourse acknowledgment [15].

Max-Pooling: Into max-pooling a channel has been predetermined, also these channels are later executed over the non-overlapping sub-areas of the info considering the maximum of the qualities confined into the space like the yield. Dimensionally, just like the computation expense for becoming familiar with a few boundaries, can be decreased utilizing max-pooling [16].

Batch Normalization: Batch normalization decreases covariation move, accordingly quickening deep neural network. This standardizes the contributions towards a layer, against every smaller than usual bunch, when the loads are refreshed during the preparation. Standardization balances out learning and lessens the preparation ages. The soundness of a neural net-work is expanded through standardizing the yield as of the past enactment layers.

Skip-gram: Words inserting calculations are demonstrated utilizing Skip-gram. During the skip-gram models, two jargon word shares a comparable setting; at that point such words have been indistinguishable. For instance, the statements "felines are warm blooded creatures" as well as "canines are vertebrates" have been significant statements that has a similar signifying "are well evolved creatures." Skip-gram is executed through taking into account a setting space holding n words and trains the neural network by avoiding one of this term and afterward utilize the models for anticipating the omitted terms [17].

Transfer learning: During transfer learnings, models prepared for a specific assignment has been misused for additional connected undertaking. The information got whereas tackling a specific issue is moved towards additional networks, where this has to be prepared at a connected issue. It takes into account fast advancement and upgraded execution while tackling the second issue [18].

V. APPLICATIONS

DL network is utilized into an assortment of utilizations, for example, self-driving vehicles, Natural Language Processing, Google's Virtual Assistant, Visual Recognition, Fraud discovery, medical services, recognizing formative [7] delay in kids, adding sound to quiet motion pictures, programmed machine interpretation, text to picture interpretation, picture to picture blend, programmed picture acknowledgment, Image colorization, seismic tremor expectation, market-rate determining, news collection and misrepresentation news identification.

VI. CONCLUSION

Deep learning is persistently developing; even quicker, there are various issues to manage and can be settled utilizing deep learning. Despite the fact that a entire comprehension of the functioning of DL has been as yet a puzzle, one could built machine more intelligent utilizing DL, here and there much more astute compared to humans. Presently the point is to grow DL model which works by portable towards making the application more astute also cleverer. Leave DL alone further contributed to the advancement of humankind and hence forming our area a superior spot for living.

REFERENCES

1. Bengio, Y.; Courville, A.; Vincent, P. (2013). "Representation Learning: A Review and New Perspectives". IEEE Transactions on Pattern Analysis and Machine Intelligence. 35 (8): 1798–1828.
2. Schmidhuber, J. (2015). "Deep Learning in Neural Networks: An Overview". Neural Networks. 61: 85–117.

3. Bengio, Yoshua; LeCun, Yann; Hinton, Geoffrey (2015). "Deep Learning". *Nature*. 521(7553): 436–444.
4. Deng, L.; Yu, D. (2014). "Deep Learning: Methods and Applications". *Foundations and Trends in Signal Processing*. 7 (3–4): 1–199.
5. Bengio, Yoshua (2009). "Learning Deep Architectures for AI". *Foundations and Trends in Machine Learning*. 2 (1): 1–127.
6. <https://neuronerdz.com/a-neural-history-of-deep-learning/>
7. Amitha Mathew, P.Amudha, S.Sivakumari, "Deep Learning Techniques: An Overview", All content following this page was uploaded by Amitha Mathew on 02 August 2020. DOI: 10.1007/978-981-15-3383-9_54.
8. Anil K Jain. Data clustering: 50 years beyond k-means. *Pattern recognition letters*, 31(8):651-666, 2010. doi: 10.1016/j.patrec.2009.09.011.
9. Sotiris Kotsiantis and Dimitris Kanellopoulos. Association rules mining: A recent overview. *GESTS International Transactions on Computer Science and Engineering*, 32(1):71-82, 2006.
10. Volodymyr Mnih, Adria Puigdomenech Badia, Mehdi Mirza, Alex Graves, Timothy Lillicrap, Tim Harley, David Silver, and Koray Kavukcuoglu. Asynchronous methods for deep reinforcement learning. In *International conference on machine learning*, pages 1928-1937, 2016.
11. Li Deng, Dong Yu, et al. Deep learning: methods and applications. *Foundations and Trends in Signal Processing*, 7(3-4):197-387, 2014. Doi :10.1007 /978-981-13-3459-73.
12. Abhishek Panigrahi, Yueru Chen, and C-C Jay Kuo. Analysis on gradient propagation in batch normalized residual networks. *arXiv preprint arXiv:1812.00342*, 2018.
13. Jonathan Lorraine and David Duvenaud. Stochastic hyperparameter optimization through hypernetworks. *arXiv preprint arXiv:1802.09419*, 2018.

14. Anil K Jain. Data clustering: 50 years beyond k-means. *Pattern recognition letters*, 31(8):651-666, 2010. doi: 10.1016/j.patrec.2009.09.011.
15. Alessandro Achille and Stefano Soatto. Information dropout: Learning optimal representations through noisy computation. *IEEE transactions on pattern analysis and machine intelligence*, 40(12):2897-2905, 2018. doi: 10.1109/TPAMI.2017.2784440.
16. Toshihiro Takahashi. Statistical max pooling with deep learning, July 3 2018. US Patent 10,013,644.
17. Chaochun Liu, Yaliang Li, Hongliang Fei, and Ping Li. Deep skip-gram networks for text classification. In *Proceedings of the 2019 SIAM International Conference on Data Mining*, pages 145-153. SIAM, 2019.
18. Sinno Jialin Pan and Qiang Yang. A survey on transfer learning. *IEEE Transactions on knowledge and data engineering*, 22(10):1345-1359, 2009. doi: 10.1109/TKDE.2009.191.

Emerging Technologies in Engineering Research



Chapter 18: Big Data Analytics

Dr. Murugananth Gopal Raj

A. Sangeerani Devi

D. Kavitha

Dr. B. Uma Maheswari

Technical Research Publications

ISBN: 978-93-5419-211-1 (Online)

BIG DATA ANALYTICS

Dr Murugananth Gopal Raj¹, A Sangeerani Devi², D Kavitha³, Dr B Uma Maheswari⁴

¹Professor & Head, Department of Electrical and Electronics Engineering,
Ahalia School of Engineering and Technology, Palakkad, Kerala, India.

^{2,3}Assistant Professor, Department of Computer Science and Engineering,
Sri Sairam Engineering College, Chennai, Tamilnadu, India.

⁴Associate Professor, Department of Computer Science and Engineering,
St. Joseph's College of Engineering, Chennai, Tamilnadu, India.

Abstract: Recently, organization has started understanding the importance of data affability into enormous amounts towards settling upon the right selections as well as backing its methods. By the improvement of novel innovations, the Internet as well as informal organizations, the formation of hi-tech data has been constantly emerging. The word "Big Data" refers towards the varied mass of advanced data shaped by corporations as well as public whose attributes (massive volume, several structure, rapidity of formulating) need exact also gradually modern Personal Computing stockpiling as well as analysis devices. This chapter plans to characterize the plan of Big Data, its ideas, types and characteristics, just as the significance of Big Data Analytics.

Keywords: Big Data, Data Mining, Hadoop and Big Data Analytics.

I. INTRODUCTION

Big Data is frequently portrayed as amazingly huge data sets that have developed past the capacity to oversee and investigate them with customary data preparing devices. Scanning the Web for signs uncovers a practically general definition, shared by most of those advancing the philosophy of Big Data, that can be dense into something like this: Big Data [1] characterizes a circumstance in which data sets have developed to such huge sizes that ordinary data advancements can presently don't viably deal with either the volume of the datasets or the scale and development of the datasets. As such, the data set has developed so enormous that it is hard to oversee and significantly harder to collect value out of it. The essential troubles are the

241

securing, stockpiling, looking, sharing, analytics, and visualization of data. There is considerably more to be said about what Big Data really is. The idea has developed to incorporate the size of the data set as well as the cycles engaged with utilizing the data [2]. Big Data has even gotten inseparable from other business ideas, for example, business intelligence, analytics, and data mining.

As analytics and exploration were applied to enormous data sets, researchers arrived at the resolution that more is better - for this situation, more data, more analysis, and more outcomes. Analysts began to join related data sets, unstructured data, authentic data, and ongoing data into the cycle, which thus brought forth what we currently call Big Data.

II. BIG DATA CHARACTERISTICS AND TYPES

2.1 Characteristics:

Maybe it is ideal to consider Big Data in multi-trademark terms, in which four qualities identify with the essential parts of Big Data. These qualities can be characterized as follows:

Volume: This represents the amount of information available – which is estimated as Gigabytes has been currently estimated as Zettabytes (ZB) otherwise Yottabytes (YB). The IoT (Internet of Things) has been making remarkable development into data. The volume of information has anticipated towards changing essentials in the future.

Velocity: This represents the rapidity where information is measure and gets accessible. It recollects the times of day-to-day groups, presently if it's not ongoing it's typically not sufficiently quick.

Variety: It represents perhaps the biggest test of big data. This tends to be not structured as well as this could integrate those countless various sorts of information as of XML towards audiovisual to SMS. Categorizing the information in a significant manner is no straightforward task, predominantly once the information itself varies rapidly.

Variability: This is hardly the similar like variety. A café might tender 6 exclusive combinations of espresso, yet on the off chance such as one gets a same combination daily also this taste

distinctive constantly, and this shows variability. The equivalent is valid towards information, when the importance has been continually transforming this could hugely influence our information homogenization.

Veracity: It has been knotted by guaranteeing the information has been precise, that demands cycles towards shielding the terrible data as of aggregating into our framework. The utmost clear-cut model is contact which enters our endorsing robotization frameworks by bogus name as well as wrong communication information. How often have you seen Mickey Mouse in your database? It is the exemplary "trash in, trash out" challenge.

Visualization: This has been elementary nowadays. Using outlines as well as diagrams toward envision numerous multifaceted data has considerably further viable into transitory on significance compared to accounting pages as well as details stuffed by numbers plus recipes.

Value: It's the final game. Subsequent to tending to volume, velocity, variety, variability, veracity, and visualization – that consumes a ton of time, effort as well as asset – it needs certainty with the association for receiving value as of the information.

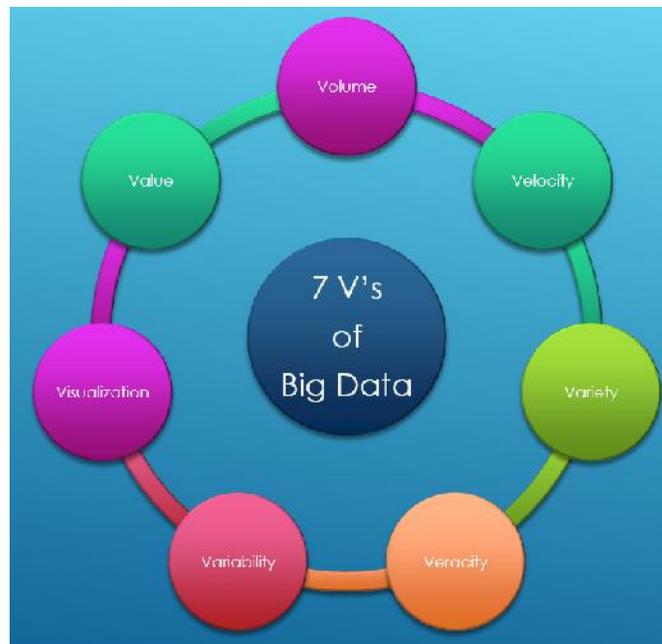


Figure.1: Seven V's of Big Data

2.2 Types

- **Structured Data** – This represents the data that can be prepared, put away, and can be recovered in a fixed organization i.e., we can say that when data is put away and separated, it should be in a legitimate way/format.
- **Unstructured Data** – This sort of data comes up short on any structure and is put away for what it's worth. Breaking down such data is tedious just as trying.
- **Semi-structured Data** – This sort of data is a blend of the over two kinds of big data i.e., structured and unstructured data. It is otherwise called cross hybrid big data.

III. ANALYSIS CATEGORIES OF BIG DATA

A significant number of those advances or ideas are not new but rather have come to fall under the umbrella of Big Data. Best characterized as analysis classes, these innovations and ideas incorporate the accompanying:

Traditional Business Intelligence (BI): This comprises of an overall cataloging of usages as well as improvements in communal events, incarceration, investigating, also providing admittance toward data. BI conveys noteworthy data, which helps endeavor clients settle on better business choices utilizing truth based emotionally supportive networks. BI works by utilizing a top to bottom analysis of definite business data, given by databases, application data, and other substantial data sources. In certain circles, BI can give authentic, current, and predictive perspectives on business activities.

Data Mining: This is a cycle in which information is examined as of alternative viewpoint also later converted to outline information that are considered helpful. Data mining is regularly utilized with data very still or with chronicled data. Data mining strategies center around demonstrating and information revelation for predictive, instead of absolutely descriptive, purposes—an ideal cycle for revealing new examples from huge data sets.

Statistical Applications: These gander on information using calculation reliant on factual ethics also frequently emphasis upon datasets recognized through reviews, inventory, as well as

additional constant datasets. Measurable applications preferably carry examination observations which is used towards reading inhabited datasets towards gauging, examining, as well as predictive analysis. Precise information, such as, reviews as well as exploratory detailing, has been the vital hot spot of analyzable information.

Predictive Analysis: It's a subsection of factual application where datasets have been inspected toward concoct expectations, considering pattern as well as information collected as of database. Predictive analysis will in general be big in the monetary and logical universes, where moving will in general drive forecasts, when outside components are added to the data set. One of the primary objectives of predictive analysis is to recognize the dangers and open doors for business cycle, markets, and assembling.

Data Modeling: This is a theoretical utilization of analytics in which different "consider the possibility that" circumstances are operated through computation towards various datasets. Preferably, the displayed data alters depending upon the information made available for the calculation, which then gives knowledge through the effects of the alteration over the datasets. Data displaying functions completely through data visualization, where exposing information could assist by a precise commercial try.

The first analysis classifications establish just a segment of where Big Data is going and why it has inborn value to business. That value is driven by the endless journey for an upper hand, urging associations to go to enormous archives of corporate and outer data to reveal patterns, insights, and other significant data to assist them with choosing their best course of action. This has assisted the idea of Big Data to pick up prevalence with technologists and heads the same, alongside its related instruments, stages, and analytics.

IV. ANALYTICS OF BIG DATA

Big Data by and large alludes to data that surpasses the ordinary stockpiling, preparing, and processing limit of traditional database as well as data analyzing procedures. Like an asset, Big Data needs devices also techniques which is executed towards examining also separating examples as of enormous scope information [3]. The examination of organized information

develops because of the variety and velocity of the information controlled. Consequently, it's not, at this point sufficient for examining information also generates report, the extensive variation of information implies that the frameworks set up should be fit for aiding the analysis of information. The analyzing comprises of consequently defining, inside a variation of quickly evolving information, the connections between the information to help into the misuse of it.

Big Data Analytics refers toward the method to gather, putting together, dividing up huge data sets towards finding various instances also additional valued information. Big data analytics has a bunch of developments as well as measures which need novel kinds of joining towards revealing huge hidden values as of huge dataset which is unique in relation to the distinctive one, further unpredictable, also of a huge fabulous scope. This principally centers around taking care of new issues otherwise longstanding issues into healthier as well as successful manners [4].

Types of Big Data Analytics

Descriptive Analytics:

This comprises of requesting the inquiry: What's going on? This has been a primer phase of information handling which makes a bunch of verifiable information. Data mining strategies put together information also support reveal designs which offers knowledge. Descriptive analytics gives upcoming possibilities as well as patterns furthermore provides a thought regarding anything may occur later on.

Diagnostic Analytics:

This comprises of requesting the inquiry: Why did it occur? Diagnostic analytics searches for the main driver of an issue. This has been utilized towards deciding how come somewhat occurred. These sort endeavors towards discovering also comprehend the reasons for occasions as well as practices.

Predictive Analytics:

This comprises of requesting the inquiry: What is probably going to occur? This utilizes previous information toward anticipate what's to come. It is tied in with gauging. Predictive

analytics utilizes numerous methods such as data mining also man-made consciousness towards investigating existing information as well as build situations of which exactly may occur.

Prescriptive Analytics:

This comprises of requesting the inquiry: What should be finished? This has been devoted towards discovering the correct move that should be made. Descriptive analytics gives an authentic information, also predictive analytics assists conjecture which exactly with occurring. Prescriptive analytics utilizes such boundaries towards locating the finest arrangement.

V. HADOOP FOR BIG DATA APPLICATIONS

Big Data is assortments of data which is viewed as monstrous, difficult to store and measure, 10 years prior. The handling of such enormous amounts of data forces specific techniques. An exemplary database the board framework can't measure as much data. Hadoop is an open-source programming item that is cooperatively created and uninhibitedly circulated through the Apache Foundation – adequately, this has been a designer's toolbox intended for streamlining the structure of Big Data arrangements [5].

Hadoop has been utilized through organizations by enormous sizes of information toward measure. Between them is web monsters, for example, Facebook, Twitter, LinkedIn, eBay as well as Amazon. Hadoop has been an appropriated information preparing also the executives framework. This comprises a large number, together with: HDFS, YARN, Map Reduce. HDFS has been a circulated record framework which gives superior admittance to data across Hadoop bunches [6].

MapReduce has been a middle segment of the Apache Hadoop programming system. Hadoop allows tough, disseminated handling of gigantic not structured dataset through item PC groups, where every hub of the bunch incorporates their personal stockpiling. MapReduce assists two basic capacities: These packages out effort towards different hubs inside the group otherwise guide, also this coordinates as well as decreases the outcomes as of every hub towards a firm response towards a question [7].

Hadoop depends upon two servers:

Job Tracker: It has just a single Job Tracker per Hadoop group. This gets Map/Reduce task toward executing as well as arranges its implementation upon the clusters. Once presenting our programming for execution over the Hadoop group, it's the JobTracker's duty towards assembling an implementation idea. These implementation plans incorporate defining the hubs which comprise information toward work on, masterminding hubs for comparing through information, checking executing task, also relaunching task on the off chance that they fizzle [8].

Task Tracker: A few for every group. Performs the Map/Reduce effort on its own (like a Map and Reduce job through the related information). The Job Tracker worker has in correspondence by HDFS; this recognizes where the Map/Reduce program key-in information is also where the yield information should be put away. This would therefore be able to upgrade the dissemination of tasks as per the related information.

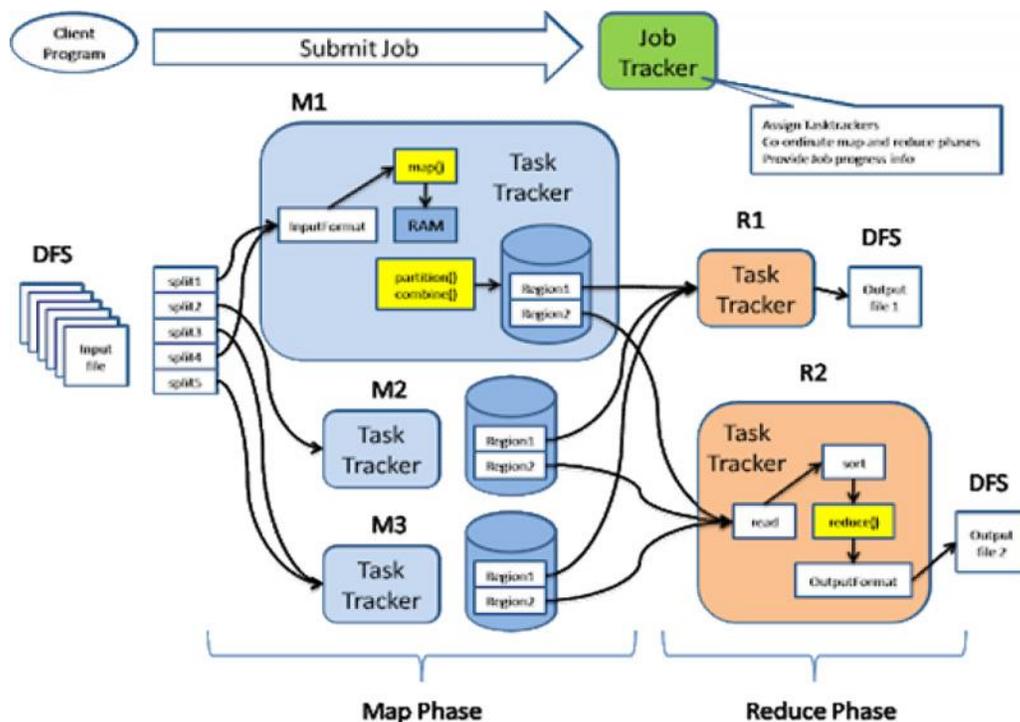


Figure.2: Hadoop Map Reduce Architecture

For executing a Map/Reduce program, follow the below steps:

- Enter key-in information into HDFS
- Surrender the code towards the cluster's Job Tracker.
- Recover outcome information as of HDFS.

Every Task Tracker reports its position consistently over heart-beat bundles. On the off chance that a Task Tracker comes up short, the Job Tracker tells the rearrangement of the task to another hub:

Name Node: Special on the bunch. This saves data around document names also its qualities. This has been the expert of the HDFS which rules servant Data Node.

Secondary Name Node: The Secondary Name Node screens the condition of the HDFS group also acquires "depictions" of the information confined into the Name Node. In the event that the Name Node comes up short, at that point the Secondary Name Node is utilized instead of the Name Node [8].

Data Node: Numerous through group. Saves the substance of the records themselves, divided into chunks (64KB as a matter of course).

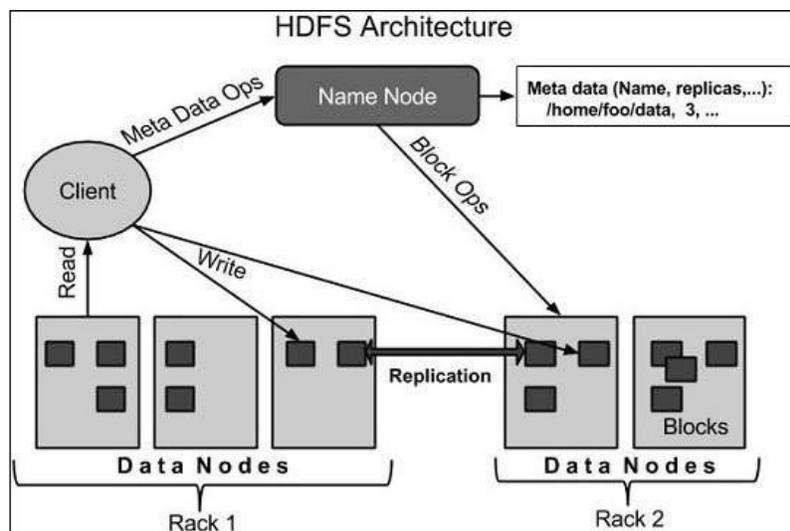


Figure.3: HDFS Architecture

VI. CONCLUSION

Big data alludes toward the arrangement of mathematical information delivered through the utilization of novel innovations for individual or expert purposes. Big Data analytics has the way toward inspecting such information toward reveal shrouded beatings, business patterns, client inclinations as well as additional helpful data to settle on the correct choices. Big Data Analytics has been a quickly developing innovation. This is received through the utmost sudden ventures also turned into a business all alone. In any case, analysis of such information into the structure of the Big Data has a cycle which appears to be once in a while very nosy.

REFERENCES

1. Youssra Riahi, Sara Riahi, “Big Data and Big Data Analytics: Concepts, Types and Technologies”, International Journal of Research and Engineering, Volume 5, No. 9, September – October 2018, pp.524-528.
2. Riahi, Azzeddine and S. Riahi. “The Big Data Revolution, Issues and Applications.” IJARCSSE, Volume 5, Issue 8, 2015.
3. Najafabadi et al., “Deep learning applications and challenges in big data analytics”, Journal of Big Data (2015) 2:1 DOI 10.1186/s40537-014-0007-7.
4. Jai Prakash Verma, Smita Agrawal, Bankim Patel and Atul Patel, “Big Data Analytics: Challenges And Applications For Text, Audio, Video, And Social Media Data”, International Journal on Soft Computing, Artificial Intelligence and Applications (IJSCAI), Vol.5, No.1, February 2016.
5. Big Data- The definitive guide to the revolution in business analytics-Fujitsu.
6. <http://searchbusinessanalytics.techtarget.com/definition/Hadoop-Distributed-File-System-HDFS>.
7. <http://searchcloudcomputing.techtarget.com/definition/MapReduce>.
8. <http://www.informit.com/articles/article.aspx?p=2008905>.

Emerging Technologies in Engineering Research



Chapter 26: Artificial Intelligence of Things

Dr. Murugananth Gopal Raj

D. Sathish Kumar

R. Janaki

K. Sivasankari

Technical Research Publications

ISBN: 978-93-5419-211-1 (Online)

ARTIFICIAL INTELLIGENCE OF THINGS

Dr Muruganath Gopal Raj¹, D Sathish Kumar², R Janaki³, K Sivasankari⁴

¹Professor and Head, Department of Electrical and Electronics Engineering,
Ahalia School of Engineering and Technology, Palakkad, Kerala, India.

²Assistant Professor, Department of Computer Science and Engineering,
Sri Sairam Engineering College, Chennai, Tamilnadu, India.

³Assistant Professor, Department of Electronics and Communication Engineering,
Sri Sairam Institute of Technology, Chennai, Tamilnadu, India.

⁴Assistant Professor, Department of Electronics and Communication Engineering,
Sri Sairam Institute of Technology, Chennai, Tamilnadu, India.

Abstract: The aim of the chapter provides an overview of the area of Artificial Intelligence of Things (AIoT). We will discuss the definition of AIoT, look at needs in AIoT, segments in more detail, and discuss a number of applications. Due to the nature of the subject, we cannot be exhaustive, but rather want to give a feeling for research in the combined field of Artificial Intelligence and Internet of Things.

Keywords: Artificial Intelligence of Things, Artificial Intelligence and Internet of Things.

I. INTRODUCTION

Artificial Intelligence of Things (AIoT) is a moderately new term and has as of late become an intriguing issue which joins two of the most sultry abbreviations, Artificial Intelligence (AI) and Internet of Things (IoT). IoT comprises of interconnected things with worked in sensors and can possibly generate or gather an immense measure of information. The information can be then investigated and used with AI for critical thinking or dynamic [1]. Without AI, IoT would have restricted worth. Simulated intelligence can increase the estimation of IoT; then again, IoT can advance the learning and intelligence of AI.

In any case, there are numerous difficulties while sending AIoT practically speaking. For example, the edge figuring issues for addressing the inactivity of sending colossal IoT information in organizations and accomplishing constant reactions with superior AI for dissecting the gigantic information. Security issue is another urgent test to give wellbeing and protection in AIoT applications. AI is one of the potential advancements to be used in AIoT system insurance. Also, there are numerous different issues identified with the expanding current AIoT systems and applications. Since the blend of AI and IoT, in particular AIoT, has different possible applications in reality.

II. ARTIFICIAL INTELLIGENCE OF THINGS

The AIoT is the blend of AI advancements with the IoT foundation to accomplish more effective IoT tasks, improve human-machine collaborations and upgrade information management and examination [2]. Simulated intelligence can be utilized to change IoT information into valuable data for improved dynamic cycles, subsequently making an establishment for fresher innovation, for example, IoT Data as a Service (IoT DaaS).

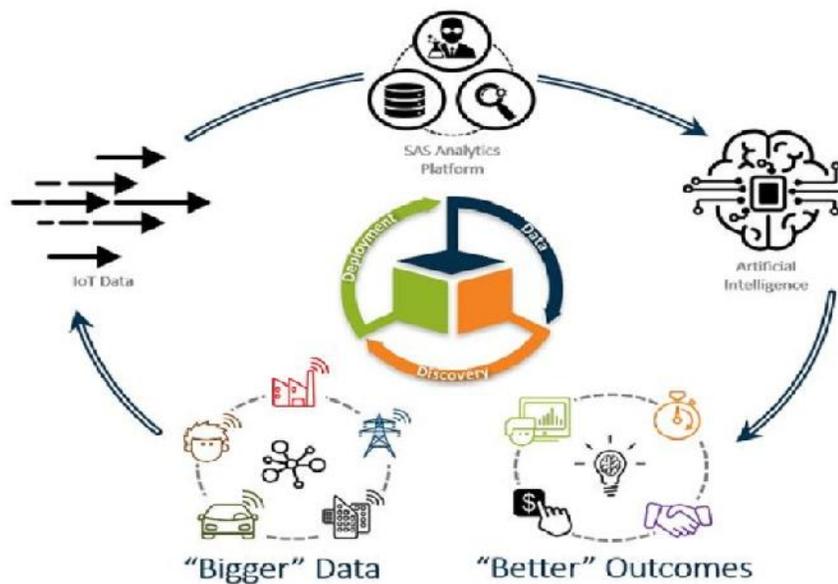


Figure.1: How AIoT Works

AIoT is groundbreaking and commonly gainful for the two kinds of innovation as AI enhances IoT through AI abilities and IoT enhances AI through network, flagging and information trade. As IoT networks spread all through significant enterprises, there will be an inexorably huge measure of human-situated and machine-generated unstructured information. AIoT can offer help for information investigation arrangements that can make an incentive out of this IoT-generated information.

With AIoT, AI is installed into framework segments, for example, programs, chipsets and edge registering, all interconnected with IoT organizations. APIs are then used to broaden interoperability between segments at the gadget level, programming level and stage level. These units will zero in fundamentally on streamlining system and organization tasks just as removing an incentive from information.

While the idea of AIoT is still generally new, numerous prospects exist to improve industry verticals, for example, endeavor, modern and shopper item and administration areas, and will keep on emerging with its growth. AIoT could be a suitable answer for tackle existing operational issues, for example, the cost related with powerful human capital management (HCM) or the intricacy of supply chains and conveyance models.

III.SEGMENTS OF ARTIFICIAL INTELLIGENCE OF THINGS

There are four significant segments in which the AIoT is having an effect: wearables, smart home, smart city, and smart industry [3]:

3.1 Wearables

Wearable gadgets, for example, smart watches ceaselessly screen and track client inclinations and propensities. Not just has this prompted significant applications in the wellbeing tech area, it additionally functions admirably for sports and wellness. As indicated by driving tech research firm Gartner, the worldwide wearable gadget market is assessed to see more than \$87 billion in income by 2023.

3.2 Smart Home

Houses that react to all your solicitations are not, at this point confined to sci-fi. Smart homes can use machines, lighting, electronic gadgets and then some, learning a homeowner's propensities and creating computerized "uphold."

This consistent access likewise achieves extra advantages of improved energy effectiveness. Therefore, the smart home market could see a compound annual growth rate (CAGR) of 25% among 2020-2025, to reach \$246 billion.

3.3 Smart City

As an ever increasing number of individuals rush from rustic to metropolitan zones, urban communities are developing into more secure, more helpful spots to live. Smart city advancements are keeping pace, with ventures going towards improving public wellbeing, transport, and energy effectiveness.

The pragmatic utilizations of AI in traffic light are now getting clear. In New Delhi, home to a portion of the world's most traffic-clogged streets, an Intelligent Transport Management System (ITMS) is being used to make 'constant powerful choices on traffic streams'.

3.4 Smart Industry

To wrap things up, ventures from assembling to mining depend on computerized change to turn out to be more productive and decrease human mistake.

From constant information investigation to store network sensors, smart gadgets help forestall expensive mistakes in industry. Truth be told, Gartner additionally gauges that more than 80% of big business IoT ventures will incorporate AI by 2022.

IV. CHALLENGES AND APPLICATIONS

IoT comprises of interconnected things with worked in sensors and can possibly generate or gather an immense measure of information. The information can be then examined and used

with AI for critical thinking or dynamic. Without AI, IoT would have restricted worth. Man-made intelligence can duplicate the estimation of IoT; then again, IoT can advance the learning and intelligence of AI.

In any case, there are numerous difficulties while sending AIoT by and by. For example, the edge figuring issues for settling the inactivity of communicating gigantic IoT information in organizations and accomplishing continuous reactions with superior AI for breaking down the enormous information. Security issue is another pivotal test to give wellbeing and protection in AIoT applications. AI is one of the potential advances to be used in AIoT system security. Moreover, there are numerous different issues identified with the expanding present day AIoT systems and applications.

Since the blend of AI and IoT, in particular AIoT, has different possible applications in reality. The combo of internet of things and smart systems makes AIoT an incredible and significant apparatus for some applications [4]. Here are a few,

Smart Retail: In a smart retail climate, a camera system furnished with PC vision abilities can utilize facial acknowledgment to recognize clients when they stroll through the entryway. The system assembles intel about clients, including their sexual orientation, item inclinations, traffic stream and the sky is the limit from there, breaks down the information to accurately foresee customer conduct and afterward utilizes that data to settle on choices about store tasks from promoting to item arrangement and different choices. For instance, if the system identifies that most of clients strolling into the store are Millennials, it can promote out item commercials or in-store specials that appeal to that segment, in this manner driving up deals. Smart cameras could distinguish customers and permit them to avoid the checkout like what occurs in the Amazon Go store.

Robot Traffic Monitoring: In a smart city, there are a few commonsense employments of AIoT, including traffic observing by rambles. On the off chance that traffic can be checked continuously and changes in accordance with the traffic stream can be made, clog can be diminished. At the point when robots are conveyed to screen a huge zone, they can communicate

traffic information, and afterward AI can break down the information and settle on choices about how to best reduce gridlock with acclimations as far as possible and timing of traffic signals without human contribution. The ET City Brain, a result of Alibaba Cloud, improves the utilization of metropolitan assets by utilizing AIoT. This system can distinguish mishaps, unlawful stopping, and can change traffic signals to assist ambulances with getting patients who need help quicker.

Places of business: Another territory where artificial intelligence and the internet of things meet is in smart places of business. A few organizations decide to introduce an organization of smart ecological sensors in their place of business. These sensors can distinguish what staff are available and change temperatures and lighting in like manner to improve energy proficiency. In another utilization case, a smart structure can handle building access through facial acknowledgment innovation. The mix of associated cameras and artificial intelligence that can analyze pictures taken progressively against a data set to figure out who ought to be allowed admittance to a structure is AIoT grinding away. Likewise, workers wouldn't have to check in, or participation for compulsory gatherings wouldn't need to be finished, since the AIoT system deals with it.

Fleet Management and Autonomous Vehicles: AIoT is utilized to in armada management today to help screen an armada's vehicles, decrease fuel costs, track vehicle support, and to recognize perilous driver conduct. Through IoT gadgets, for example, GPS and different sensors and an artificial intelligence system, organizations can deal with their armada better gratitude to AIoT. Another way AIoT is utilized today is with self-governing vehicles, for example, Tesla's autopilot systems that utilization radars, sonars, GPS, and cameras to accumulate information about driving conditions and afterward an AI system to settle on choices about the information the internet of things gadgets are gathering.

Autonomous Delivery Robots: Similar to how AIoT is utilized with self-ruling vehicles, self-sufficient conveyance robots are another illustration of AIoT in real life. Robots have sensors

that assemble data about the climate the robot is navigating and afterward settle on second to-second choices about how to react through its installed AI stage.

V. CONCLUSION

In this chapter titled “Artificial Intelligence of Things”, we have discussed about the short introduction of AIoT, how it will work, what are the segments of AIoT with real time example and also discussed about the realistic models of AIoT. In future, we can use this AIoT technique in many equipments implementation and also we can use this AIoT technique for bringing better performance of many appliances.

REFERENCES

1. Gerry Christensen, “Artificial Intelligence of Things (AIoT)”, Internet technologies, Verticals, February 2019, <https://internetofthingsagenda.techtarget.com/definition/Artificial-Intelligence-of-Things-AIoT>
2. Bernard Marr, “What Is The Artificial Intelligence Of Things? When AI Meets IoT”, Enterprise Tech, December 2019, <https://www.forbes.com/sites/bernardmarr/2019/12/20/what-is-the-artificial-intelligence-of-things-when-ai-meets-iot/#43c09627b1fd>
3. Vinugayathri, “AI and IoT Blended - What It Is and Why It Matters?”, Clarion Technologies, 2020, <https://www.clariontech.com/blog/ai-and-iot-blended-what-it-is-and-why-it-matters>.
4. <https://internetofthingsagenda.techtarget.com/definition/Artificial-Intelligence-of-Things-AIoT>

Understanding Blockchain Technology

Edition First

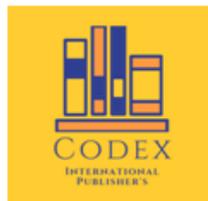
Authors

Dr. D. Sivaganesan

Dr. Reji Ravi

Dr. Murugananth Gopal Raj

Dr. Sujith S



Codex International Publishers

Title of the Book: Understanding Blockchain Technology

Edition: First - 2022

Copyright 2022 © Authors

**Dr. D. Sivaganesan, Dr. Reji Ravi, Dr. Murugananth Gopal Raj,
Dr. Sujith S**

No part of this book may be reproduced or transmitted in any form by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owners.

Disclaimer

The authors are solely responsible for the contents published in this book. The publishers don't take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

ISBN: 978-93-94799-05-9

MRP: Rs. 299/-

PUBLISHER & PRINTER: Codex International Publishers

35M, 3rd PHASE, WATER TANK ROAD

HOUSING BOARD, CHIKMAGALUR

Karnataka, 577102

Tel.: +91-9035199400

E-mail: codexinternationalpublishers@gmail.com

IMPRINT: Codex International Publishers

Preface

Blockchain is an emerging technology that makes it easy to transact securely through the Internet. It utilizes various comprehensive technologies with several technical aspects and can be applied to any discipline. Blockchain is mainly used for asset registration, inventory, and exchange of finance and other materials. Assets can be tangible or intangible. This book, “understanding Blockchain Technology”, is a collection of various definitions and illustrations available through the Internet, and rewritten as the most straightforward version for the reader to understand, the technical glitches of the Technology to a certain extent. We hope that this book will be helpful to readers in understanding Blockchain Technology.

Dr. D. Sivaganesan
Dr. Reji Ravi
Dr. Murugananth Gopal Raj
Dr. Sujith S

Acknowledgements

It is with sincere veneration that, first of all we owe our humble thanks to our family members who bestowed on us the necessary strength, courage and good health. Without their wishes and blessings it would not have been possible for us to bring out this manuscript.

Today when our endeavor has successfully reached its culminating point. We extend our profound gratitude to the Management of PSG Institute of Technology and Applied Research, Coimbatore, Carmel College of Engineering and Technology, Alappuzha, Ahalia School of Engineering and Technology, Palakkad, and NSS College of Engineering, Palakkad.

Last but not the least we are thankful to one and all that helped us during this strenuous academic journey.

Dr. D. Sivaganesan
Dr. Reji Ravi
Dr. Muruganath Gopal Raj
Dr. Sujith S

Contents

Chapter No.	Chapter Name	Page No.
Chapter 1	What is Blockchain Technology?	1-18
1.1	Introduction	1
1.2	What a Blockchain is?	4
1.3	Basic Components of Blockchain	8
1.4	Working of a Blockchain	13
1.5	Key Benefits of Blockchain Technology	14
1.6	Blockchain Protocol	14
1.7	Possible Ways to use Blockchain	15
1.8	Blockchain Evolution	15
1.9	Terminologies Used in Blockchain Technology	17
Chapter 2	Basic Concepts of Blockchain Concepts	19-45
2.1	Introduction	19
2.2	Measures of Confidence	19
2.3	Blockchain vs. Distributed Ledger	20
2.4	Issues of Mistrust	20
2.5	Types of Networks	20
2.6	Distributed Network	21
2.7	Ledger	22
2.8	Immutable	23
2.9	Cryptographic Identity	27
2.10	Smart Contract	28
2.11	Consensus Mechanism	30
Chapter 3	Types of Blockchains	46-54
3.1	Introduction	46
3.2	Permissioned Blockchains	46
3.3	Permissionless Blockchains	48
3.4	Which is Better? – Private or Public Blockchain	54
Chapter 4	Basic Concepts of Cryptography	55-74
4.1	Introduction	55
4.2	Cryptography in Blockchain	55
4.3	Definition of Cryptography	56
4.4	Terminologies Used in Cryptography	56
4.5	Encryption and Decryption	56
4.6	Cryptography Algorithms & Keys	57

4.7	Types of Encryption	57
4.8	Wallets and Digital Signatures	63
4.9	Application of Cryptography to Blockchain	66
Chapter 5	Building an Own Blockchain	75-82
5.1	Introduction	75
5.2	Creating Own Blockchain	75
Chapter 6	Applications of Blockchain Technology	83-103
6.1	Introduction	83
6.2	Money Transfer	83
6.3	Financial Exchanges	84
6.4	Lending	85
6.5	Insurance	88
6.6	Real Estate	88
6.7	Securing Personal Information	89
6.8	Voting System	90
6.9	Government Benefits	93
6.10	Healthcare Systems	96
6.11	Royalties	98
6.12	Non-Fungible Tokens	99
6.13	Logistics and Supply Chain Management	100
6.14	Data Storage	100
6.15	Gambling Industries	101
Chapter 7	Blockchain and Internet of Things	104-109
7.1	Introduction	104
7.2	Working of IoT with Blockchain	104
7.3	Blockchain in IoT	105
7.4	Combined Role of Cloud, AI and IoT	106
7.5	Benefits of IoT and Blockchain	107
7.6	Applications of Combined IoT and Blockchain	107

Vol-I Proceedings



Aqua Foundation's XIII World Aqua Congress

International Conference & Exhibition

30th - 31st October, 2019, New Delhi, India



Editor
Dr. Sanjay Rana

Theme: Water for all – Leaving no one behind

Cleared by:



Ministry of Home Affairs
Govt. of India

Ministry of External Affairs
Govt. of India

Ministry of Jal Shakti
Dept. of Water Resources,
RD&GR, Govt. of India



National Water
Mission
Govt. of India
Ministry of
Jal Shakti



Central Water
Commission
Govt. of India
Ministry of
Jal Shakti



PHD Rural
Development
Foundation



Central Board
of Irrigation
And Power



International
Commission
on Irrigation
and Drainage



Construction
Industry
Development
Council



For a better life on a greener planet
Energy and
Environment
Foundation

Sponsored by:



NABARD
National Bank For
Agriculture and Rural
Development



Ministry of
Earth Sciences
Govt. of India



PARSAN Overseas



Geo Vale Services



Electrosteel Castings



Global Water
Intelligence



Smart Water &
Waste World



Everything About Water



Water Digest



British Water

Media Support:



PARSAN Overseas



Geo Vale Services



Electrosteel Castings



The SME Times



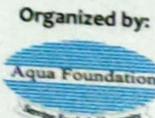
The SME Times



The Water Network



B2B Purchase



Aqua Foundation

Organized by:



Aqua Foundation

SUSTAINABLE DEVELOPMENT MODEL – AHALIA CAMPUS IN KERALA

KRIPA K. M.*, NEETHU JOHN, INDU M., DR. KRISHNA K. KISHOR,
DR. P. R. SREEMAHDEVAN PILLAI

Ahalia School of Engineering and Technology, Palakkad – 678557, Kerala.
[*kripa.devan@ahalia.ac.in](mailto:kripa.devan@ahalia.ac.in)

THEME: RAINWATER HARVESTING

ABSTRACT

Ahalia is the largest edu-health campus in the State of Kerala, located in a water scarce and rain shadow region, close to Plachimada, from where Coca Cola had to leave, after being forced to stop ground water tapping. The second biggest industrial region of Kerala, Kanjikode, is adjacent to the Ahalia Campus. Two decades back, the Ahalia Campus was founded on an arid extent of land, with very rare green sprouts and absence of water. Rain water conservation has done miracle to this campus and it is now a fully green water conserved campus, the largest in Kerala. Over the past two decades, Ahalia Campus has constructed ten rainwater harvesting lakes with a total capacity of approximately 230 Million litres. These lakes are designed and constructed considering the topography of the land. Channels and pipes, above and below the water surface, are made to ensure that rainwater from rooftops, roads and other catchment areas is directed to these rainwater harvesting lakes for in-situ reuse rather than allowing run off. A rainwater harvesting system comprises of various components such as pipes or drains for transporting rainwater, chambers for intermediate diversion, filtration tanks and storage tanks. Rainwater harvesting has always been proposed as a solution to recharge the local aquifers and ensure water availability in water-scare zones. While this technique is a long-term and cost-effective solution and relatively less complex to construct, the availability of land is often the bottleneck. LDPE sheets are placed in the borders at the lowest elevation (or level) to prevent water from overflowing to the surrounding region. During heavy rainfall, when the lakes overflow, chambers divert water to the surrounding areas. The water conservation efforts in Ahalia campus have been recognized several times by the Kerala State Pollution Control Board (PCB). The presence of these lakes have greatly benefitted the campus and the nearby locality by maintaining the water table high, especially during the hot summers. Besides this, these water bodies help in maintaining a thriving eco-system and is a source of relaxation for human body and mind. The development of the Ahalia Campus in this arid region has become a saga in the history of Kerala. At present, this self-sustained campus is accommodating 10 academic institutions including IIT Palakkad, 4 hospitals, a medicine manufacturing unit, a large herbarium, a heritage village, a rock sculpture museum, a children's village, a dozen lake houses, half-a-dozen theme parks, etc., making it a centre of attraction for movie makers. It has become a destination for students' visit from many institutions. The campus also has its own production of grains, vegetables, flowers, milk, egg, etc., making it a loveable place to stay, self-sustained in water, energy (wind) and much more. This paper discusses the real-life story in words and pictures of the development from scratch of this wonderful campus, by judicious water conservation.

Keywords: rainwater harvesting, conservation, ground water, self-sustained, eco-system

1. INTRODUCTION

With the world developing at a rapid pace, governments and international bodies have understood the need to focus on sustainable development; that is development that meets the present needs

of the people while ensuring nature's resources are reserved for future generations. One of the most important players in sustainable development is the environment. This is evident in the fact that five out of the seventeen sustainable development goals (SDGs) of the United Nations Development Programme are directly related to the environment [1]. India too has a strong commitment to the implementation of the seventeen SDGs as well as a high priority to the 2030 Agenda for Sustainable Development [2].

In this paper, we discuss about Ahalia Health, Heritage and Knowledge Village (AHHKV) [3] (fondly called Ahalia Campus) in Palakkad District, in the State of Kerala, India. The focus on health, heritage and knowledge is visionary and critical as they are inherited from the past, maintained in the present and bestowed for the benefit of the future generations. While still in its infancy, Ahalia Campus has come a long way in its vision of becoming a sustainable model. Section 2 describes Ahalia Campus in more detail. Section 3 covers the major efforts taken by the Campus in becoming water, energy and food self-sufficient.

2. ABOUT AHALIA CAMPUS

Ahalia is the largest edu-health campus in the State of Kerala, located in a water scarce and rain shadow region, close to Plachimada, from where Coca Cola had to leave, after being forced to stop ground water tapping. The second biggest industrial region of Kerala, Kanjikode, is adjacent to the Ahalia Campus. Two decades back, the Ahalia Campus was founded on an arid extent of land, with very rare green sprouts and absence of water. Rain water conservation has done miracle to this campus and it is now a fully green water conserved campus, the largest in Kerala. At present, this self-sustained campus is accommodating ten academic institutions including IIT Palakkad, four hospitals, a medicine manufacturing unit, a large herbarium, a heritage village, a rock sculpture museum, a children's village, a dozen lake houses, half-a-dozen theme parks, etc., making it a centre of attraction for movie makers. A few of these are shown in Figures 1 to 5. It has become a destination for students' visit from many institutions. The campus also has its own production of grains, vegetables, flowers, milk, egg, etc., making it a loveable place to stay, self-sustained in water, energy and much more.



Figure 1: Ahalia School of Engineering and Technology



Figure 2: Ahalia Ayurveda Medical College Hospital



Figure 3: Ahalia Diabetes Hospital



Figure 4: Ahalia Foundation Eye Hospital

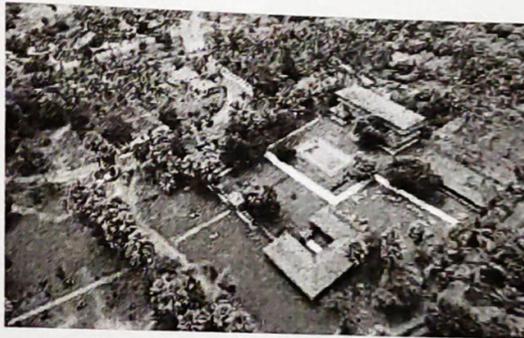


Figure 5: Ahalia Heritage Village

3. DEVELOPMENT OF A SUSTAINABLE ECO-SYSTEM IN AHALIA CAMPUS

3.1. Rainwater harvesting

Rainwater, where it falls naturally, is often not sufficiently or efficiently managed. Rainwater harvesting is a technology used for collecting and storing rainwater from rooftops, land surface or rock catchments using simple techniques. A rainwater harvesting system comprises of various components such as pipes or drains for transporting rainwater, chambers for intermediate diversion, filtration tanks and storage tanks. Thus, rainwater harvesting is a cost-effective and relatively lesser complex way of water conservation while ensuring sustained long-term supply of water, especially in those areas where there is inadequate groundwater supply or surface resources. Rainwater harvesting has always been proposed as a solution to recharge the local aquifers and ensure water availability in water-scare zones [4]. While this technique is a long-term and cost-effective solution and relatively less complex to construct, the availability of land is often the bottleneck.

Over the past two decades, Ahalia Campus has constructed ten rainwater harvesting (RWH) lakes with a goal of being water self-sufficient. The total capacity of these lakes is approximately 230 million litres. A view of some of these lakes are shown in Figures 6, 7 and 8. These lakes are designed and constructed considering the topography of the land. Channels and pipes, above and below the water surface, are made to ensure that rainwater from rooftops, roads and other catchment areas is directed to these rainwater harvesting lakes for in-situ reuse rather than allowing run off. LDPE sheets are placed in the borders at the lowest elevation (or level) to prevent the water from overflowing to the surrounding region (refer Figure 9). During heavy rainfall, when the lakes overflow, chambers divert water to the surrounding areas. The water conservation efforts in

Ahalia campus have been recognized several times by the Kerala State Pollution Control Board (PCB). The presence of these lakes have greatly benefitted the campus and the nearby locality by maintaining the water table high, especially during the hot summers. Besides this, these water bodies help in maintaining a thriving eco-system and is a source of relaxation for human body and mind.



Figure 6: RWH lake beside the lake houses



Figure 7: RWH lake in front of Ahalia Foundation Eye Hospital



Figure 8: RWH lake near Ahalia Women and Children's Hospital



Figure 9: LDPE sheet laying in one of the borders of the RWH lake

3.2 Renewable energy efforts

Ahalia's endeavor towards energy self-reliance, energy secured future and developing clean energy started more than a decade ago. The efforts to explore the wind potential of Kanjikode area, where the campus is located, were initiated through various studies and an 80 m lattice wind mast of make Suzlon was commissioned in May 2007 in the campus and wind data was measured at 80 m, 65 m and 50 m levels for the period from April 2008 to March 2009. Subsequently a separate company, Ahalia Alternate Energy Pvt. Ltd. (AAEPL), was formed to channelize and prioritize the efforts in developing renewable energy in the year 2013. The company embarked upon the ambitious project of commissioning 8.4 MW at its campus in Kanjikode - the first of its kind by a Private investor in the state, after due discussion with Kerala State Electricity Board (KSEB).

As per the on-site wind data wind turbine generators, each having a capacity of 2.1 MW, are placed at four different locations which yields the highest wind generation. These are shown in Figures 10 and 11. The hub height of the turbines is at 90 metres above ground level to obtain the maximum wind generation. The rotor is of horizontal axis type and the rotational direction is clockwise. Depending upon the wind speed and direction, the blade angle and angle of turbine is controlled. The SCADA system is used for acquiring the generation data on a daily basis. The

power output of the generator is 690 V which is converted into 22 kV (grid voltage) using a step up transformer. All the machines are connected to the 22 kV grid and thus work in Independent Power Producer (IPP) mode. The machines were commissioned on 22 February 2016 (one machine) and 23 March 2016 (three machines) respectively, under IPP mode and started injecting power to the grid.

The project with investment of more than Rs. 50 crore was executed under the direct control of AAEPL in a span of just one year. The technical, administrative, strategic and liaison wings of AAEPL worked in tandem and in coordination with the wind turbine manufacturer to achieve the enviable task within the minimum time frame and budget. Snaps of some of the logistical work are seen in Figures 12, 13 and 14. The machines have injected 65 million units to the grid till 31 July 2019. It is noteworthy that these machines exceeded the pessimistic generation predictions of energy private entrepreneur of the state. This higher generation efficiency is again an indication of the site-machine matching practiced by AAEPL, as the yield is much higher than the other two projects in the same region.

It is pertinent to state that the project undertaken and commissioned by AAEPL is the first project in Kerala, where the developer is also from the state, who technically involved in the planning, installation and commissioning of the project. Ahalia Alternate Energy Ltd has a competent team and is sharing its exposure and expertise in the field of wind energy by providing consultancy services to M/S V Guard, Kottakkal Arya Vaidya Sala etc. Ahalia Alternate Energy is consultant to Swedish consortium of E4T micro-grid concept in Andaman and Nicobar Islands in 2015-16, a partnership venture of KTH – The Royal Institute of Technology, Stockholm and Swedish Energy Agency under the aegis of MNRE.



Figure 10: A view of two of the windmills



Figure 11: An aerial view of the four windmills, Ahalia Public School and one of the RWH lakes are also seen.



Figure 12: Transportation of the hub of the windmill



Figure 13: Transportation of the blade of the windmill

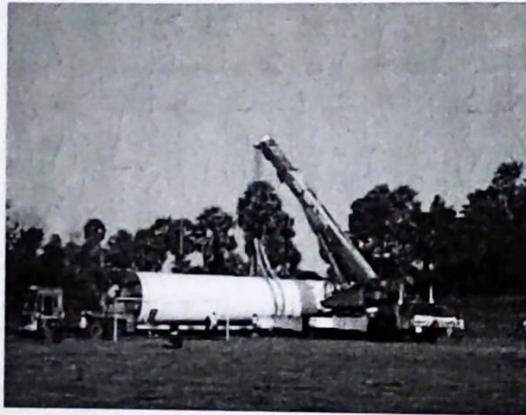


Figure 14: Unloading of one of the sections of the windmill

3.3 Agriculture and livestock

Ahalia Campus has an extensive green belt that is used for various agriculture and environment related projects. There are earmarked locations for cultivation of paddy, herbal plantation (medicinal plants of five thousand different varieties, Figure 15 shows one of these), vegetables (such as tapioca, radish, brinjal, ladies finger, cabbage, etc.), palm trees, cashew trees, mango trees, coconut trees, bamboo (refer Figure 16), jasmine plantation, neem trees, flowering plants (refer Figure 17) and other spice trees. As part of our afforestation efforts, every year around thousand saplings are grown, planted and taken care of (refer Figure 18). Our water conservation efforts have significantly helped us maintain our landscapes during the summer season as well. In addition to these, there is a farm in the campus with cattle, poultry, goose, turkey, rabbits and goats (refer Figure 19). Fish farming and sericulture are other activities.



Figure 15: One of the herbal gardens in campus



Figure 16: Bamboo park



Figure 17: Rose garden



Figure 18: A greenhouse for saplings

4. CONCLUSION

To summarize, Ahalia Campus is an excellent example of an inclusive development model that keeps both nature and the people in mind. The rainwater harvesting farms and the 8.4 MW wind energy project were amongst the first in the state of Kerala. The development of this campus in this arid region has become a saga in the history of Kerala. While much has been achieved, Ahalia Campus constantly strives to move forward in the fields of healthcare, education and heritage while maintaining its harmony with nature.

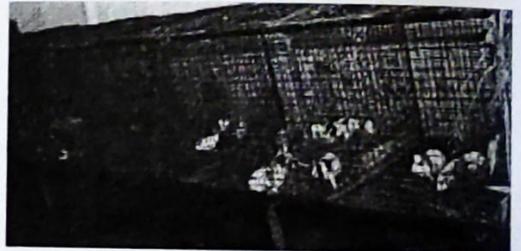
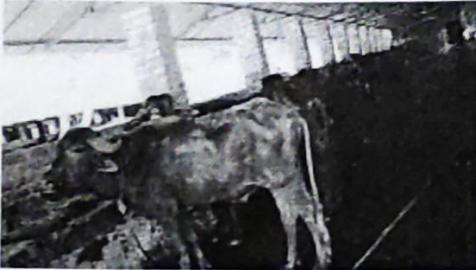


Figure 19: Some of the livestock in the farm

5. REFERENCES

- [1] United Nations Development Programme, <https://www.undp.org/content/undp/en/home.html>
- [2] Research and Informational System for Developing Countries, "*India and Sustainable Development Goals: The Way Forward*", 2016
- [3] Ahalia Health, Heritage and Knowledge Village, Palakkad, Kerala, India, www.ahalia.in
- [4] United Nations Water (UN-Water), <https://www.unwater.org/>

++++



Aqua Foundation Academy

AFA is an entity of Aqua Foundation, registered under Societies act in year 1998. AFA provides training & knowledge sharing platform to decision & policy makers, working professionals, operating level personnel and aspiring students willing to specialize in technical sector.

Courses offered

- ❖ PG Diplomain Ground Water Geophysics
- ❖ PG Diploma in Integrated Water Resources Management
- ❖ PG Diplomain Geophysics
- ❖ Diploma in Enhancing Water Use Efficiency
- ❖ Diploma in Land Surveying
- ❖ Certificate Course in Hydrogeology
- ❖ Certificate Course in Artificial Recharge to Groundwater
- ❖ Certificate Course in Groundwater Geophysics
- ❖ Certificate Course in Enhancing Water Use Efficiency in Agriculture Sector
- ❖ Certificate Course in Enhancing Water Use Efficiency in Industrial Sector
- ❖ Certificate Course in Enhancing Water Use Efficiency in Rural Sector
- ❖ Certificate Course in Enhancing Water Use Efficiency in Urban Sector
- ❖ Certificate Course in GIS & Remote Sensing
- ❖ Certificate Course in Land Surveying

Training & Workshops

- ❖ Training workshops on various aspects of dam safety including inspection, investigations, repair & rehabilitation, sedimentation etc.
- ❖ Training workshops on Pipeline Leak Detection
- ❖ Training workshops on niche topics like Subsurface Utility Engineering (Detection and Mapping of Underground Utilities), Tunnelling Geophysics, Water Resources Geophysics etc.



Contact Details:

AF Academy

(an entity of Aqua Foundation)

E – 166, Second Floor, Kalkaji, New Delhi 110 019 (India)

Mob: +91-9818568825, 9873556395, Telefax: +91-11-41318030

Email- info@aquafoundation.in; Website : www.afacademy.info



ISBN 978-93-5382-386-3



PROCEEDINGS BOOK