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Global Warming: New Frontier of Research Deep Learning- Age of Distributed Green Smart Microgrid

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ABSTRACT: The exponential increase in carbon-dioxide resulting Global Warming would make the planet earth to become inhabitable in many parts of the world with ensuing mass starvation. The rise of digital technology all over the world fundamentally have changed the lives of humans. The emerging technology of the Internet of Things, IoT, machine learning, data mining, biotechnology, biometric, and deep learning facilitate the development of distributed green smart microgrids. We have gained godlike powers as to become unrecognizable, and we have the power to destroy ourselves through environmental mismanagement and nuclear calamities.

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1. INTRODUCTION: GLOBAL WARMING

The Intergovernmental Panel on Climate Change (IPCC) issued its report on global warming in October 2018. While the front-page IPCC headline warning is timely, so does the fact. The IPCC report asks us a fundamental question: How much threat does climate change pose to us as we dial up global temperatures? Simply, as we continue to load nearly 50 billion tons of CO2 equivalent and other climate-changing materials into the atmosphere each year? Will we reach a tilting point? The report leaps into this issue in a coordinated and precise way. It looks at the effects of some detailed levels of climate change—evaluating influences precisely at 1.5 and 2.0 degrees warming scenarios above pre-industrial concentrations. It also explored a broader range of likely warming consequences. It then combines and integrates what we know from earlier published scientific, peer-reviewed, and otherwise scrutinized literature. These warming present the change ecosystems, sea-level rise, human health, livelihoods, communities, and highly unbearable summer temperature, drought, and resulting dust storm. A significant and vital aspect of this analysis presents how these dangers impact life with growing temperature. It asks how much more would heavy rainfall events happen in a world of 1.5 degrees warming compared to today. How much more severe drought would get if warming increased to 2 degrees or beyond?"[1]

It is distressing, not because researchers are shocked by the finding but because, in its totality, the finding is astonishing alarming. "The diversity and severity of impacts from climate change read like a narrative we might see in a Hollywood movie, but are in fact, and disconcertingly, the clear-eyed projections of where we are heading in reality, barring massive economic mobilization and rapid transition to cleaner technologies."[2]

Fig. 1 presents the basic findings. IPCC FAR projected global warming in the business as usual emissions scenario using climate models with equilibrium climate sensitivities of 1.5°C (low), 2.5°C (best), and 4.5°C (high) for double atmospheric CO2.

The extreme vulnerability depicted in Fig. 2 shows that if that scenario happens, no place on earth habitable. Such a future is desolate for the next generation. What are the researchers saying? The answer is that they have been giving a warning about harsh global impacts from climate change for more than thirty years. The past 12 months, those warnings have intensified. The shocks are massive environmental, economic, and human consequences of runaway global warming that have come at a fast with intense pace. These impacts are far scarier as projection shown in Figs. 1 since IPCC prediction is highly conservative.

Hopefully, that is only a scenario that will never occur — Fig. 3 depicting the scenario for the year 2050. The color of yellow depicts as a warning sign. It is telling us we are reaching the point of falling into the point of no return and run away climatic destruction of earth habitat. Human activities contribute to the production of carbon dioxide—

1 https://www.ipcc.ch

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2 https://www.brookings.edu/opinions/were-almost-out-of-time-the-alarming-ipcc-climate-report-and-what-

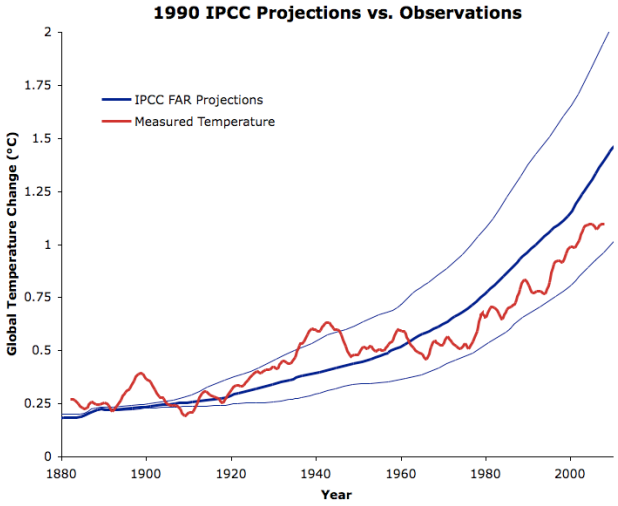

Fig. 1. Lessons from Past Climate Predictions: IPCC FAR[1]

[1] https://www.ipcc.ch/report/ar4/wg1/global-climate-projections/

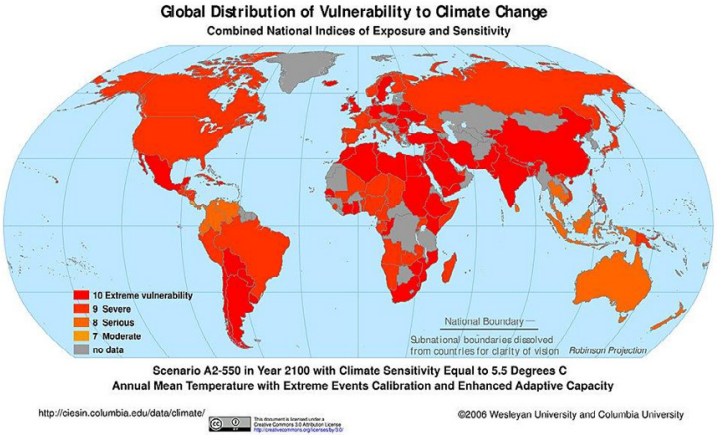

Fig. 2. The Scenario of the year 2100

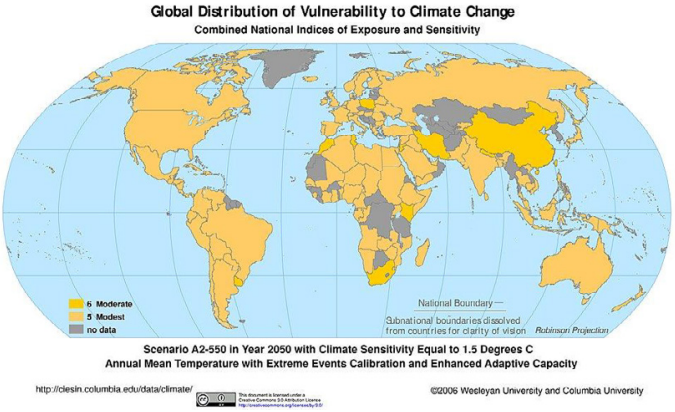

Fig. 3. The Scenario of the year 2050[2]

[2] https://sedac.ciesin.columbia.edu/data/collection/ipcc/maps /gallery/search

generally from the burning of fossil fuels, but also cement, and deforestation, changes. It is roughly, in 2015, 40 billion metric tons of carbon dioxide dumped into the atmosphere. As of this writing, the United States of America has abandoned the Paris Climate accord. Since 2000, the world has doubled its coal-fired power capacity to around 2000. China has rapidly slowed down the number of new plants being built. It also has been shut down many hundreds of smaller, older, and highly polluting units after smogs of recent years in Beijing. However, the industrialization of India is continuing, and

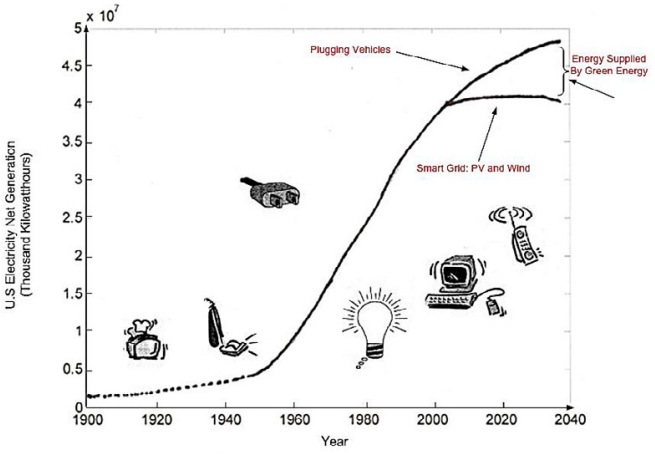

Fig. 4. Electric Energy Production and Industrialization[3]

[3] Source: Energy Information Administration, U.S Department of Energy (DOE), U.S Data History, Available at https://www.eia.doe.gov/

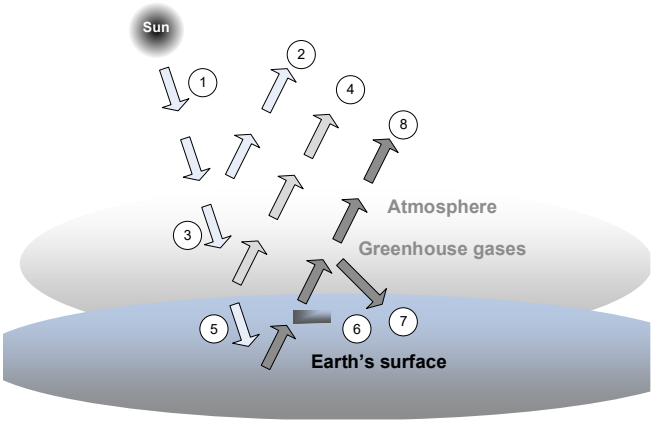

Fig. 5. The Effects of Sun Radiation on the Surface of the Earth.

thirst for cheap coal-fired plants is increasing.[1]

Can the world take the scenario of 2050 seriously as more flood, drought, and storms play havoc on the population? We should have trust in the wisdom of humanity coming together to address this immense crisis.

2. HISTORICAL PERSPECTIVE- ENERGY AND CIVILIZATION

Energy technology plays a central role in societal, economic, and social development. Fossil fuel-based technologies have advanced our quality of life, but at the same time, these advancements have come at a very high price. Fossil fuel sources of energy are the primary cause of environmental pollution and degradation of the environment. Carbon dioxide (CO2) produces the vast majority of greenhouse gas emissions from fossil fuel, but smaller amounts of methane (CH4) and nitrous oxide (N2O) are emitted in the process. These gases are emitted during the burning of fossil fuels, such as coal, oil, and natural gas, to produce electricity. Global warming is a result of our fossil fuel consumption. The processing and use of fossil fuels have escalated public health costs. Our relentless search for and need to control these resources have promoted political strife and war. We are now dependent on an energy source that is unsustainable as our energy needs to grow, and we deplete our limited resources.

Fig. 4 presents the use of energy and its impact on industrialization. Fig. 5 depicts the process of solar radiation incident energy and reflected energy from the earth's surface and the earth's atmosphere. Greenhouse gases in the earth's atmosphere emit and absorb radiation. This radiation is within the thermal infrared range. Since the burning of fossil fuel and the start of the Industrial Revolution, the carbon dioxide in the atmosphere has substantially increased.

In Fig. 5, the solar radiation incident energy, as depicted by circle 1 emitted from the sun and its energy is approximated as 343 W/m2. Some of the solar radiation, depicted by circle 2 and circle 4, is reflected from the earth's surface and the earth's atmosphere. The total reflected solar radiation is approximated as 103 W per m2. Approximately 240 W per m2 of solar radiation, depicted by circle 3, penetrates through the Earth's atmosphere. About half of the solar radiation depicted by circle 5, approximately 168 W per m2, is absorbed

1 https://www.carbonbrief.org › mapped-worlds-coal-power-plants

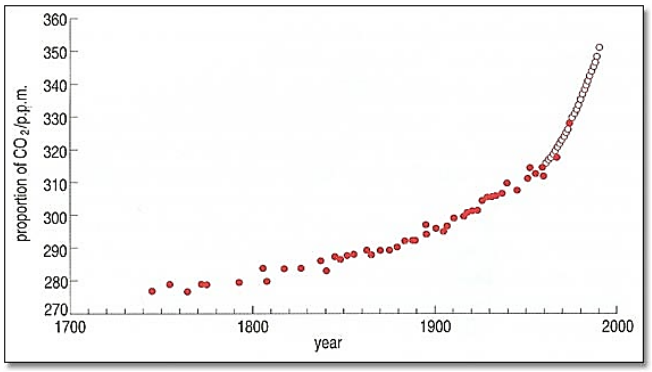

Fig. 6. Historical and recorded CO2 in the atmosphere since the start of industrialization.

by the Earth's surface. This radiation is depicted by circle 6, and it is converted into heat energy. This process generates infrared radiation in the form of the emission of a long wave back to Earth. A portion of the infrared radiation is absorbed. Then, it is re-emitted by the greenhouse molecules trapped in the earth's atmosphere. Circle 7 represents the infrared radiation. Finally, some of the infrared radiation (circle 8) passes through the atmosphere and into space. As the use of fossil fuel is accelerated, the carbon dioxide in the earth's atmosphere is also increased.

Fig. 6 exhibits exponential growth. When it comes to the growth of CO2, we need to understand the consequences. It is informative that we learn the basic understanding of doubling time.

dt = 70/r

dt= doubling time

r= rate of growth

If r=10 then dt=7 years

If r=4, then dt=17.5 years

There is no need to dwell on the obvious. The warming effect of increasing carbon dioxide takes decades to influence the planet's temperature. Even if we cut all emissions today, we are still set for temperature rise, due to the cumulative effect of the climate. To meet a goal of 1.5 °C warming, it demands immediately cutting the planet's emissions to 45 % below 2010 levels by 2030.

3. TECHNOLOGICAL DEVELOPMENT

We have come a long way in technological development since 1900 and the expansion of industrialization. Apollo 11 was the spacecraft that first landed humans on the Moon when the Apollo Lunar Module Eagle touched the surface of the moon on July 20, 1969. A smartphone that most of us carry these days has more computing power and storage than the Apollo 11 control computer. High speed and high-resolution instrumentation systems are more powerful than in 1969.

The Human Genome Project began in 1990 with the aim of sequencing and discovering all three billion biochemical units in the human genetic instruction set. It is aiming to uncover the genetic origins of illness and then proposing treatments. Identifying the instruction codes created a megaproject since the human genome has approximately 3.3 billion base pairs. With the discovery of codes, the next step was to detect the genetic deviations that increase the risk for widespread diseases like cancer and diabetes

While displaying codes was a breakthrough in scientific learning, the genome detective work also represents something of a breakthrough in modern computing techniques. Distributed computing and database technology, enhanced search software reach the objective of uncovering the basic plan for human life. The Genome Project created a genetic blueprint for a humanoid that has a total of 3.12 billion base pairs in the human genome. A constructed genome describes as one on which the site and order of the letters of genetic code along the chromosomes are located. High-speed computers and search software developed to uncover matches in DNA sequences that serve to unravel the code.

A. DNA Computing

DNA is made up of molecules called nucleotides. Each nucleotide comprises a phosphate cluster, a sugar cluster, and a nitrogen base. The four forms of nitrogen bases are adenine (A), thymine (T), guanine (G), and cytosine (C). The order of these bases determines DNA's instructions or genetic code. DNA stands for deoxyribonucleic acid, sometimes called "the molecule of life," as almost all organisms have their genetic material codified as DNA. DNA processing is a division of computing which uses DNA, biochemistry, and molecular biology hardware, in its place of the customary silicon-based computer tools. Research and advancement in this area concerns theory, experiments, and applications of DNA computing. DNA molecules, the information our genes are made of the capability to execute calculations many times faster than the world's most advanced computers. DNA computing can be integrated into a computer chip to create a so-called biochip that will push supercomputers even faster. DNA computing is leading to the establishment of a new area of technology known as bioinformatics, which is a new discipline that is evolving out of the areas of computer science and biology [1].

B. Internet of Things (IOT Software)

In 1999, Kevin Ashton of MIT, at the center Auto-ID proposed the Radio-frequency identification of all devices

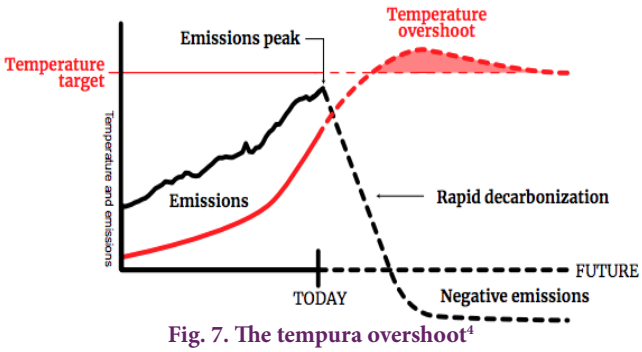

Fig. 7. The tempura overshoot[4]

[4] https://www.ipcc.ch

Fig. 8. Scope of IoT

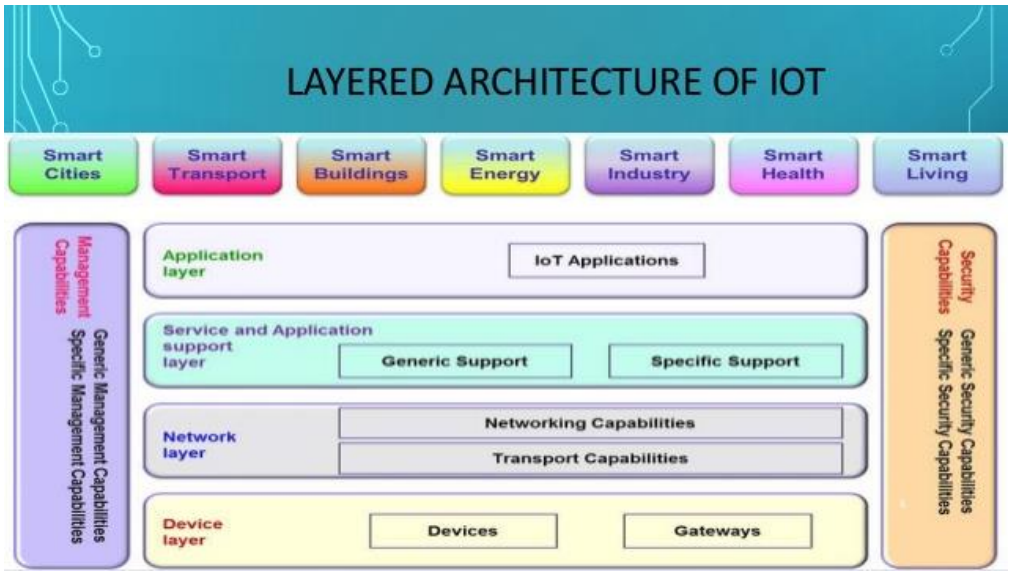

Fig. 9. IoT Architecture[5]

[5] https://www.slideshare.net/NiranjanKumar175/iot-architecture-85766356

and the Internet of Things (IoT). The Internet of Things is an organization of interrelated computing devices, machine-driven and digital machines, items, animals, or people with unique identifiers and the capability to transmit data over the web of things without needing human-to-human or human-to-computer interaction.

IoT Software development has advanced to the merging of several technologies, real-time analytics, machine knowledge acquisition, product sensors, and embedded systems. The embedded wireless sensor networks, control systems, automation, smart home smart building, the smart microgrid is leading to smart distributed green energy systems. The smart home comprises of microgrid and smart appliances that have embedded wireless WIFI. These devices are lighting fixtures, refrigerators, stove thermostats, home security systems, and cameras, and other home appliances. Smart homes can be controlled via devices connected with that network, such as smartphones and smart speakers. The scope of IoT presented in Fig. 8.

Fig. 9 depicted IoT architecture. The IoT is a network of

Fig. 10. Security in IOT

devices through a wireless connection. It is capable of tagging in real-time the connected devices and collecting data using sensors. It is also miniaturized by the use of nanotechnology that is capable of performing the computation for control implementation.

1) The structure of IoT

Applications for smart IoT system to transportation, health care, agriculture, smart retail and distribution, home, smart microgrid, and smart distributed green energy power generation and storage systems. The IoT subsystems are:

Global position systems: GPS is a global navigation satellite system that uses at least 24 satellites. It has a receiver and algorithms to provide the location, velocity, and time synchronization for air, sea, and land travel.

Gyro sensors: Identified as angular rate sensors or angular velocity sensors are mechanisms that sense angular velocity. The angular velocity is the change in the rotational angle per unit of time. Angular velocity stated in deg/s (degrees per second)

Accelerometer: A method that determines proper acceleration, being the acceleration of a body in its instantaneous rest frame.

Wifi: Wifi is a trademarked term meaning IEEE 802.11x. A WiFi network makes use of radio waves to transmit information across a network. The computer should incorporate a wireless adapter that will translate data send out into a radio signal. This same signal will be transmitted, via an antenna, to a decoder known as the router

Ethernet: Ethernet is a family of computer networking technologies commonly used in local area networks, metropolitan area networks, and wide-area networks.

Bluetooth: Bluetooth is a wireless technology specification used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific, and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks.

2) IoT Layers

The network infrastructure supports communication for Latency, bandwidth, and security. Latency in the delay before a transfer of data begins following an instruction for its transfer must be assured to obtain high-quality network performance.

The network layer must allow multiple entities to share and use the same secure network independently while assuring the encryption of data processing. The sensors of IoT captures a massive amount of raw data and processing real-time data while ensuring security and privacy. In the application layer, the IoT sensors are creating the digital nervous system by measuring physical quantities and filtering noise. In this layer, the collected data by monitoring in real-time. The smart entities such as home, microgrids, distributed green energy grids, transportation, health care, tracking people and devices, and climatic events processed in the application layer

3) IoT and Market size

In 2003 with the world population 6.3 billion, the connected device to the world wide web numbered 500 million. In 2015, with a world population of 7.2 billion, the number of connected devices rose to 25 billion. It is expected by the world population to increase to 7.6 billion and the corresponding number of connected devices to the web or Ethernet to number 50 billion. By 2025, there are projected to be additional than 75 billion IoT devices on the web. China, North America, and Western Europe. The industrial IoT market size would reach $110 billion. By 2020. Industrial IOT makes up more than 17% of the number of IOT projects worldwide. The ultimate objective of IOT is to automate human life. It is not a far-fetched idea as we all could see the coming of cashless society and debit and credit cards and self-service register at the market place. It the upcoming world of IOT, even the cows will be connected and monitored. In transporting the cows, sensors in the ear of cattle, allowing to monitor cows' health and trace their movement in the field and during transportation to supply healthier meat and milk to the market place. The amount of data collected is vast.

4) IoT Security

As depicted in Fig. 10, the security of IoT is of paramount importance. The malicious actors can hake the software for Ransome. The collected data must be made secure and not be

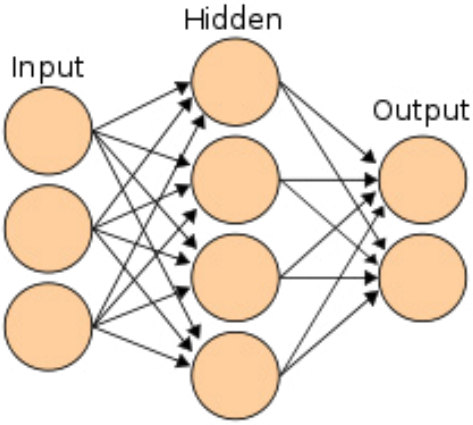

Fig. 11. A neural network (AN) is an interconnected group of nodes, analogous to the vast network of neurons in the human brain.

exposed. Certain Iot systems can be weaponized and used and a weapon of mass destruction.

5) The Impact on Quality of Life

The IoT systems will impact the quality of life and workplace, It reduces hard labor, and it is for the common good. It will restructure society and will provide challenges for humankind. The eight-hour workdays in most advanced and enlightened societies will be gone, and more time will be given to the growth and quality of life.

C. Upcoming Technologies for IoT

1) Artificial Intelligence

The artificial intelligence (AI) also refers to computer science as machine intelligence. The intelligence displayed by machine trained by humans becomes more powerful to capture knowledge that surpasses its software developer. It is the natural intelligence of humans that creates machine intelligence. In the AI study, the software entities define as the study of "intelligent agents." Any device that detects and captures information from its environment and takes actions that increase its probability of positively achieving its goals. Therefore, the term "artificial intelligence" used to designate computer machines with the "cognitive" abilities of humans associate with reasoning, comparing, and remembering. The learned knowledge is capsulated by the human mind used for problem-solving. A good example of knowledge gathered is a dictionary book. We use the dictionary to learn of the meaning of words or as translating from one language to another. The book is a source of knowledge, and we learn from it. The dictionary knowledge base does not increase. In contrast, when we use the search engine "Google" to learn, the Google search engine is also learning from us by collecting our likes and dislikes.

The Chinese game of Go has more moves than are in the universe. AlphaGo computer game developed by Deep mind technology) Google later acquired that. The Deep mind Alpha Go programmed by the permutation of different moves. AlphaGo versus Lee Sedol, an 18-time world champion, also known as the Google Deep mind Challenge Match, took place in South Korea between the 9th and 15th of March 2016[1]. AlphaGo won all but the fourth game. The match has been contrasted with the historic chess match between Deep Blue of IBM versus Garry Kasparov played in New York City in 1997 and won by Deep Blue[2].

AlphaGo had three far more formidable successors, called AlphaGo Master, AlphaGo Zero, and AlphaZero. As machines developed increasingly more capable, tasks requiring "intelligence" often removed from the definition of AI. A one-liner in Tesler's Theorem says, "AI is whatever hasn't been done yet."[3]

As an example, optical character recognition omitted from things considered to be AI and accepted as a routine technology. Modern machine abilities classified as AI include successfully understanding human speech, challenging at the highest level in tactical games like chess and Go, self-operating vehicles, and many other fields.

2) Artificial Neural Networks

The AI area in robotics or machine learning uses artificial neural networks. Fig. 11.displays the neural network architecture of neurons that attempts to display the human brain reasoning and problem-solving. Fig. 13. depicts the AN model in computer data acquisition and the modeling. Fig. 14 presents digital recurrent AN in control implementation by a digital processor. The AN network can be considered a general nonlinear mapping that related known input layers of information to output layers of interests. A neuron "*N*" accepts input from other neurons, each of which, when triggered, cast a weighted for or against whether neuron *N* must activate. Learning necessitates an algorithm to adjust these weights based on the training on measured data. One algorithm is named as fire together, must be wire together. Contemporary neural networks can attain both continuous functions and digital logical operations. Fig. 12 presents the AN model development.

In the operation of the vehicles, ninety percent of accidents

1 https://en.wikipedia.org/wiki/AlphaGo_versus_Lee_Sedol
2 https://en.wikipedia.org/wiki/Deep_Blue_versus_Garry_Kasparov
3 http://www.nomodes.com/Larry_Tesler_Consulting/Adages_and_Coinages.html

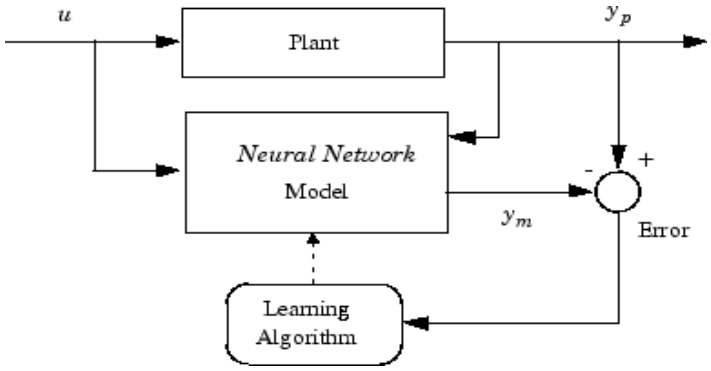

Fig. 12. The AN model development

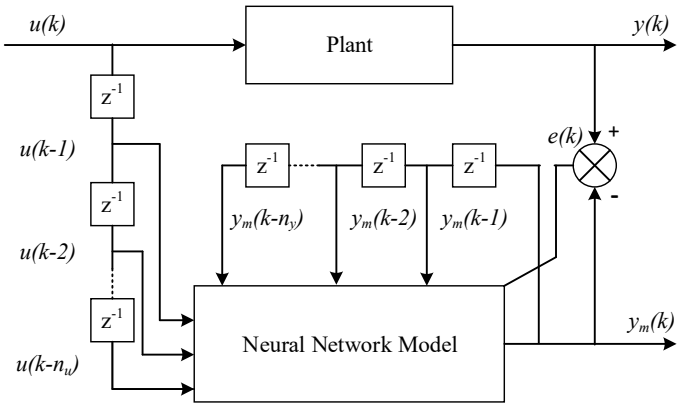

Fig. 13. The block diagram of recurrent AN model in computer data acquisition and the modeling

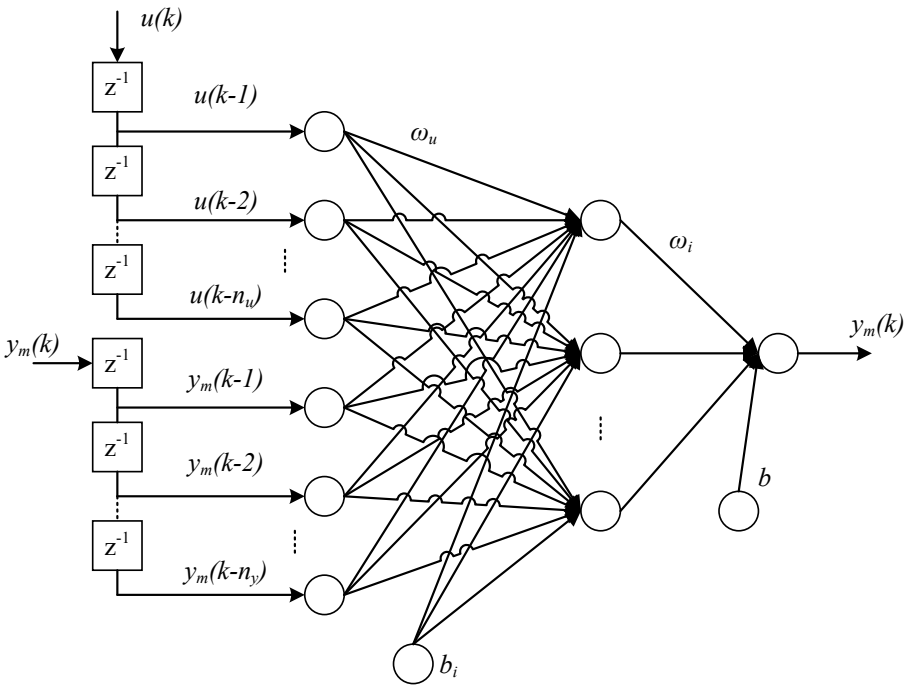

Fig. 14. Digital recurrent AN in control implementation by a digital processor.

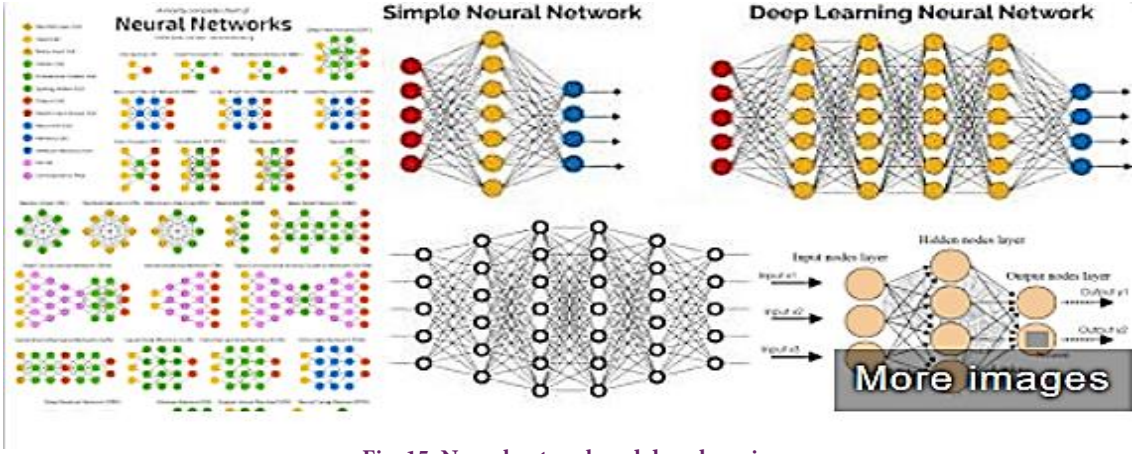

Fig. 15. Neural network and deep learning

occur due to drivers' mistakes. AI in self-driving capabilities demonstrated with a truck performance on US highways. The truck fitted with an advanced driving system that employs multi-functions, sensor fusion, deep learning visuals trained AN algorithms, and simultaneous location and mapping (SLAM) technologies. The truck drove in autonomous mode across the US highways while traveling through different terrains and weather conditions without accidents recurrent AN is applied to load and solar energy forecasting. It also used extensively in the control of robots. Currently, AN networks are often trained by the back-propagation algorithm and as the reverse mode of automatic differentiation published by Seppo Linnainmaa[1] and AN contribution by Paul Werbos [3].

AI research is expanded into problem reasoning, knowledge representation, planning, learning, natural language processing, perception, and the ability to move and manipulate objects. AI field's long-term goals include statistical methods in computational intelligence and traditional symbolic AI.

AI's objective is to simulate human intelligence precisely by software on a machine. The philosophical arguments become evident. What is the nature of the mind? How to face the ethics of creating beings endowed with human-like intelligence replacing typists, cashiers, vehicle drivers, lawyers, and doctors, to name a few professions? Is AI a danger to humankind? It seems AI, unlike earlier high-tech revolutions, will produce a risk of mass unemployment.

Advances in computer power, large amounts of collected data, and inexpensive hardware and software created a platform application of AI techniques in many activities IoT. AI has become an essential part of the technology industry, helping to solve many challenging problems in computer science, software engineering, and operations research.

The study of logic led directly to Alan Turing's theory of computation. He envisioned to simulate any conceivable act of mathematical deduction (Who was Alan Turing?". The British Library. Archived from the original on 23 July 2019.). Turing proposed changing the question from whether a machine was intelligent to "whether or not machinery can show intelligent behavior."

In 2011, a Jeopardy quiz show exhibition match[2], IBM's question answering system, called Watson, overpowered the two greatest Jeopardy champions, Brad Rutter and Ken Jennings, by a momentous margin.

The machine learning and perception deep learning methods dominate the AI field as high-speed computers with access to huge volumes of data became available. The Kinect developed by Microsoft (Will Greenwald "Hello Xbox One, Goodbye Freedom." PC Magazine. May 23, 2013.) The Kinect provides a 3D body–motion interface for the Xbox 360, and the Xbox One uses algorithms that developed from AI research. In 2017, Future of Go Summit, AlphaGo won a three-game match with Ke Jie, who held the world No. 1 ranking for two years.

The modern neural networks that reside in cloud computing infrastructure facilitated an increase in research tools and large datasets. Skype Translator of Microsoft is the new AI achievement. The Translator listens to the spoken English word from Skype phone-calling software and translates them into Spanish or vice versa[3]. Another team of Microsoft researchers has created the first machine translation system that can translate sentences of news articles from Chinese to English with the same quality and accuracy as a person. "To ensure the results were both accurate and on par with what people would have done, the team hired external bilingual human evaluators, who compared Microsoft's results to two independently produced human reference translations."[4]

A closer look at the direction of research shows that as long as we can collect data on the cause and effect of any process, we can develop the software model. The future is digital and software modeling and software control. We need to think about mapping the input data to output data and control the process. All is about coding.

Fig. 15 presents the Neural network and deep learning.

1 https://ieeexplore.ieee.org/abstract/document/6772

2 https://www.pcworld.com/article/219900/IBM_Watson_Wins_Jeopardy_Humans_Rally_Back.html

3 https://www.wired.com/2014/12/skype-used-ai-build-amazing-new-language-translator/

4 https://blogs.microsoft.com/ai/chinese-to-english-translator-milestone/

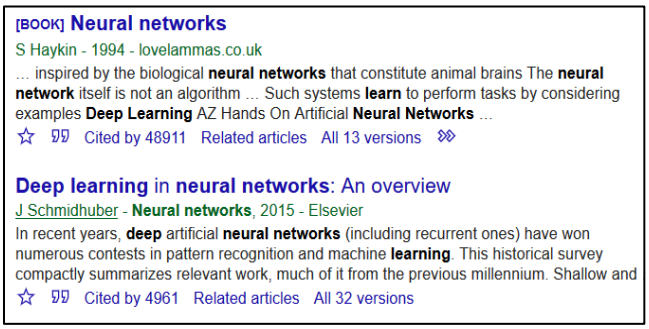

Fig. 16. Most reference articles on AI and AN and deep learning

Fig. 16. depicts most reference articles on AI and AN and deep learning

4. Government Planning

A. China AI Research.

China's state-guided development is planning itself to overtake not only the United States but every global economy in Artificial Intelligence (AI). China is graduating more than three times the number of engineers each year than any other state. The leadership of the state economy is financing and accelerating AI initiatives. China is now collecting more than ten times more data than the United States. China is taking the steps essential to lead the world in AI. China's objective is to pass the United States by 2025 and take the lead in AI in the world by 2030. In 2019, China's population stands at 1.417 billion, the largest of any country in the world. The population is approximately 91.51% of Han Chinese, and 8.49% were minorities. With that size of the population, the data is the new oil for China. Study after study shows that when we know we're being surveilled, our behaviors change. Fear creeps in. The solace of being ourselves is lost. Society will decay into a state of learned powerlessness, like dogs with shock wave collars. Our imperceptible limits are not understood. Over time adopt through pain and fear that lead to systemic mental illness varying from mass depression and suicide.

Facial identification systems are used across China. It is mostly in public security, financial services, transport, and retail. Facial recognition systems have become part of everyday life in China amid increased use of the technology in both the public and commercial sectors. China's objective is becoming a global leader in artificial intelligence (AI) in facial recognition technology. It is understood that one is watched in the world's second-largest economy. Chinese companies have already staked a claim into this growing market, where their products and services are used by organizations in both the public and commercial sectors. DeepGlint is an AI company based in Beijing that specializes in the field of computer vision. DeepGlint technology is utilized in the detection, tracking, and recognition of people and vehicles. The banks, museums and public security agencies are using DeepGlint technology. The company is exploring the application of its technology in driverless vehicles as well as robotic and smart medical systems.

Beijing-based Megvii, which is also known as Face++, was formed in 2011 by three Tsinghua University graduates. Its Face++ facial recognition software platform is accepted as the world's largest. The Face++ is used worldwide by more than 300,000 developers in 150 countries. The technology platform is implemented in China by Alibaba for payments as Alipay, mobile photo editing app provider Meitu, ride-hailing service Didi Chuxing, computer maker Lenovo Group, smartphone dealer Xiaomi, China Merchants Bank, and China Citic Bank. Megvii's technology used by the Ministry of Public Security, which oversees a facial scan database of over 1.3 billion people in China. It's an evolution that has helped China's police force arrest more than 4,000 people since 2016.

SenseTime was founded in 2014 by a group of academics involved in artificial intelligence at the Chinese University of Hong Kong. SenseTime has more than 400 customers and strategic partners, including China Mobile, HNA Group, Wanda Group, Meitu, graphics processor maker Nvidia, China UnionPay, Sina Weibo, China Merchants Bank, and mainland smartphone giants Huawei Technologies, Oppo, Vivo, and Xiaomi.

Yitu Technology, founded in 2012, Shanghai-based Yitu, has achieved wide recognition for its Dragonfly Eye System, a facial scan system that can distinguish a person from a database of at least two billion people in a matter of seconds. The company opened last month its first international office in Singapore. It has formed strategic cooperation with local governments and organizations in Britain in the fields of public security, finance, and health care. Zoloz is an Alibaba Group company that uses Alipay's payments authentication system. The technology turns a selfie of a user's eye into a biometric security key. Zoloz, now claims to have more than 200 million users worldwide. The "Smile to Pay" application was launched at an outlet of fast-food chain KFC in Hangzhou, where customers have their faces scanned to authenticate payments.

B. The US Government initiatives.

The U.S. Government-sponsored evaluations and challenge problems have assisted the-magnitude in face-recognition system performance. Since 1993, the error rate of automatic face-recognition systems has decreased by a factor of 272. The reduction applies to systems that match people

with face images captured in studio or mugshot environments. Another emerging trend uses the visual details of the skin, as taken in standard digital images. This technique, called Skin Texture Analysis, turns the unique lines, patterns, and spots apparent in a person's skin into a mathematical space. The researchers from the U.S. Army Research Laboratory (ARL) created a method that would allow them to match facial imagery obtained using a thermal camera with those in databases that were taken using a conventional camera. ARL scientists have noted that the methodology works by merging global data (i.e., features across the entire face) with local information (i.e., features involving the eyes, nose, and mouth). In addition to developing the discriminability of the integrated image, the facial identification system can be used to transform a thermal face signature into a refined visible image of a face. ARL, scientists discovered that the multi-region cross-spectrum synthesis model demonstrated a performance upgrade of about 30% over baseline methods and about 5% over state-of-the-art methods. Snap Inc. is an American established on September 16, 2011. It has three inventions: Snapchat, Spectacles, and Bitmoji. Snap Inc facial recognition technology, revolutionized and redefined the selfie, by permitting users to add filters to modify the manner they look. For example, a filter allows users to look like an old and crinkled version of themselves, one that colors their skin, and one that places a virtual flower crown on top of their head.

Face book created DeepFace that is a deep learning facial identification. It categorizes human faces in digital pictures. It employed a nine-layer neural net with over 120 million connection weights and trained on four million images uploaded by Facebook users. The system is 97% accurate, compared to 85% for the FBI's Next Generation Identification system. Face book is more powerful than the FBI and CIA with two billion users. The U.S. Department of State operates one of the largest face recognition systems in the world with a database of 117 million American adults, with photos typically drawn from driver's license photos. Japanese researchers from the National Institute of Informatics created 'privacy visor' glasses that use nearly infrared light to make the face underneath it unrecognizable to face recognition software. The latest version uses a titanium frame, light-reflective material and a mask that uses angles and patterns to disrupt facial recognition technology through both absorbing and bouncing backlight sources. In December 2016 a form of anti- facial recognition sunglasses called 'reflectances' were invented by a custom-spectacle-craftsman based in Chicago named Scott Urban.

5. Deep Learning, Data Mining, And Machine Learning.

Deep learning is a subset of machine learning, and machine learning is a subset of AI that is a software system that does something smart. Machine learning uses algorithms to analyze data, learn from that data, and make informed decisions based on what it has learned. Deep learning is a subfield of machine learning. While both fall under AI, deep learning acts powers human-like intelligence. Data Mining is a procedure for detecting hidden forms and rules from the existing data that uses rules by association and correlation rules for the decision-making process. Data mining can be used for a variety of purposes, including financial research. Data mining can be used to examine through social media profiles, websites, and digital assets to compile information on a company's ideal leads to start an outreach campaign. Machine learning represents the principles of data mining, but can also make automatic correlations and learn from them to apply to new algorithms. It's the technology behind self-driving cars that can quickly adjust to new conditions while driving. Banks are using machine learning to assist and look for fraud when a vendor swipes credit cards. Machine learning can learn from the current data and give the foundation necessary for a machine to teach itself. Zebra Medical Vision created a machine-learning algorithm to predict cardiovascular conditions and events that lead to the death of over 500,000 Americans each year. The future is positive for data science as the amount of data will only increase. The accumulated digital of data has grown from 4.4 zettabytes in 1990 to 44 zettabytes by 2020. It is just a beginning. We're just started what machine learning can do and how it will spread to facilitate our analytical abilities. As billions of machines are connected, everything from hospitals to factories to highways can be developed with IoT technology that can learn from other machines. It's an energizing time not just for scientists but for everyone that uses data in some form.

6. Smart Distributed Green Energy Network.

The exponential growth of CO^{2} must be stopped. The atmosphere of the planet is part of our living space and a not place for our carbon monoxide and all other hazardous gasses. We need to develop a sustainable modern industrial society. We need to move toward efficient and reuseable items rather than manufacture goods with limited shelf time. How we will be motivated toward sustainable societies is the question? If current trends continue, we will face the destruction of our habitats in four corners of the earth. From the optimistic view of the future, we can hope that humans will rise to upcoming challenges.

The total quantity of solar energy incident on Earth is vastly over the world's current and expected energy needs. In the 21st century, solar energy is projected to become progressively appealing as a renewable energy source because of its boundless supply and its nonpolluting nature, in plain contrast to the finite fossil fuels coal, petroleum, and natural gas. It is the time that every energy user become an energy producer. Everyone must have skin in the game. Everyone must pay a carbon tax for polluting the environment by using fossil fuel.

The technology for facilitating energy users become energy producers are here today. Smart grid and real-time pricing can be implemented in most societies. Smart distributed green generation systems can be established. Smart home with IoT system can have local green energy of wind power and solar energy. Every building has a roof that can be equipped with solar and wind power.

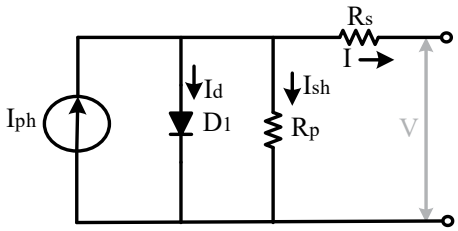

Fig. 17. Single-diode model of PV source with series and parallel resistances

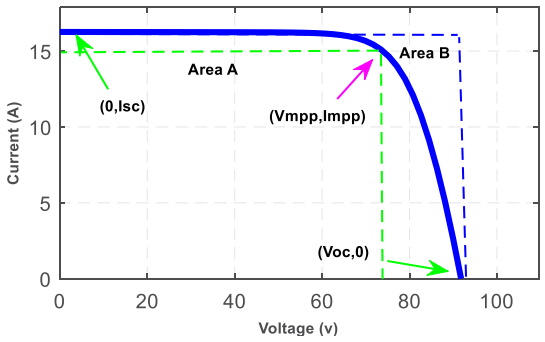

Fig. 18. Important points on the PV output curve

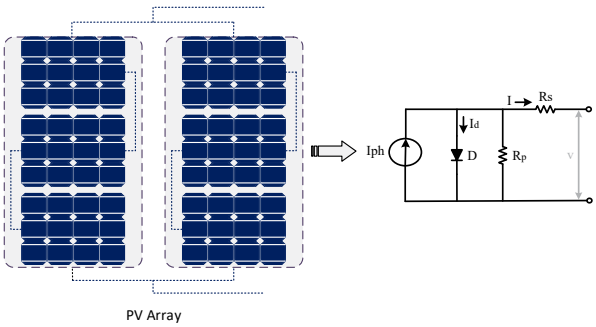

Fig. 19. Equivalent Circuit for String and Array Model.

A. Control of Microgrid of PV station.

The PV model is developed from a PV module datasheet provided by the manufacturer. The DC-DC microgrid is supplied from 1 kW PV generating station. The PV model consists of a single diode model, series and shunt resistances as depicted in Fig. 17.

The PV model consists of a current source, a diode, and series and parallel resistances. The Kirchhoff"s current law describes the relationship between voltage and current in where v, the module output voltage or input voltage of the capacitor and i is the output I_{ph} and I_0 are the photogenerated current and the dark saturation current, respectively; V_t is the junction thermal voltage; R_s and R_p are the series and parallel resistances, and n is the number of cells in the module connected in series. Where k is Boltzmann's constant, T is the junction temperature, A is the diode ideality factor, and q is the electronic charge. The model presented in Fig.2 has five unknown parameters based on the (1) : I_{ph}, I_0, V_t, R_s, and R_p. The manufacturer's data sheet provides the following information about the module: short-circuit current I_{sc}; open-circuit voltage V_{oc}; voltage V_{mpp} and current I_{mpp} at MPP; temperature coefficient for short-circuit current K_i, and open-circuit-voltage K_v. The important points on the $v-i$ characteristic used to estimate the parameters are shown in Fig. 18.

The following equations are obtained by substituting the important points in (1) and disregarding the term "-1" in comparison with the exponential term. Fig. 19 presents the modeling string and array model.

The datasheet of the PV module produced by Mitsubishi Electric, PV-UD185MF5 is used. Table 1 proves the effectiveness of the proposed method to estimate unknown

Table 1. Datasheet values and estimated parameters of a module

Datasheet Values	Estimated Parameters
$I_{sc} = 8.13$ A $V_{oc} = 30.6$ V $V_{mpp} = 24.4$ V $I_{mpp} = 7.58$ A $n_s = 50$	$I_{ph} = 8.13$ A $I_o = 0.038\ \mu$A $A = 1.31$ $R_s = 0.251\Omega$ $R_p = 1708.7\Omega$
$K_i = 0.054\%$	$K_v = -0.343\%$

Table 2. Relationship between array and module values

Module Values	Equivalent Values of Array
I_{sc}, I_{ph}	$I_{sc} \times n_p$
V_{oc}	$V_{oc} \times n_s$
V_{mpp}	$V_{mpp} \times n_s$
I_{mpp}	$I_{mpp} \times n_p$
n	$n \times n_s$
A	A
I_o	$I_o \times n_p$
R_s	$R_s \times (n_s/n_p)$
R_p	$R_p \times (n_s/n_p)$

Table 3. Estimated parameters of 1 kw array

1kw Values
$I_{ph} = 16.26$ A
$I_o = 0.076$ µA
$A = 1.24$
$R_s = 0.368\Omega$
$R_p = 2562.98\Omega$

parameters from the datasheet. From Table 1, it can be seen that the value of the series resistance is very small compared to parallel resistance, and short circuit current exactly is equal to photogenerated current. Table 1 presents sheet values and estimated values. Table 2 depicts the module parameters and equivalent array. Table 3 presents the PV module power estimated parameters of one kW Pv station. The PV station can produce a maximum of 1229 W and a minimum, 266.75 W.

To understand a microgrid generation and load frequency control (LFC), we need to review the basic concept of LFC in the steam generation unit. LFC is also referred to as the governor response control loop as shown in Fig. 18. As the load demand of the power system increases, the speed of the generators decreases, and this reduces the system frequency. Similarly, as the system load-demand decreases, the speed of the system generators increases, and this increases the system frequency. The power system-frequency control must be maintained for the power grid to remain stable.

In the AC power grids, all generating sources are operating in parallel, and all (inject) supply power to the power grid. This means that all power sources are operating at the same system frequency. The system operating frequency in the United States is 60 Hz and at 50 Hz in the rest of the world. The generators are operating at the system frequency; they are all synchronized and operating at the same synchronized speed: all are (injecting) supplying power to the power grid. For a two-pole machine, operating at 60 Hz ($f = 60$ Hz), the shaft of the machine is rotating at 3600 rpm.

The synchronized operation means that all generators of the power grid are operating at the same frequency, and all generating sources are operating in parallel. This also means that all generating units are operating at the system frequency regardless of the speed of each prime mover. In AC systems, the energy cannot be stored; it can only be exchanged between inductors and capacitors of the system and is consumed by loads. Therefore, for an AC system to operate at a stable frequency, the power generated by AC sources must be equal to the system loads. However, the loads on the system are controlled by the energy users, i.e., when we turn off a light, we reduce the system load; when we turn on a light on, we increase the system load. In response to load changes, the energy is supplied from the inertia energy stored in the massive mass of a rotor. However, at every instant, the balance between energy supplied to the grid and the energy consumed by loads plus losses are maintained. For the microgrid of Fig. 20, LFC is controlled as depicted by Fig.21 and Fig.22.

The LFC and generation is control by switching operation

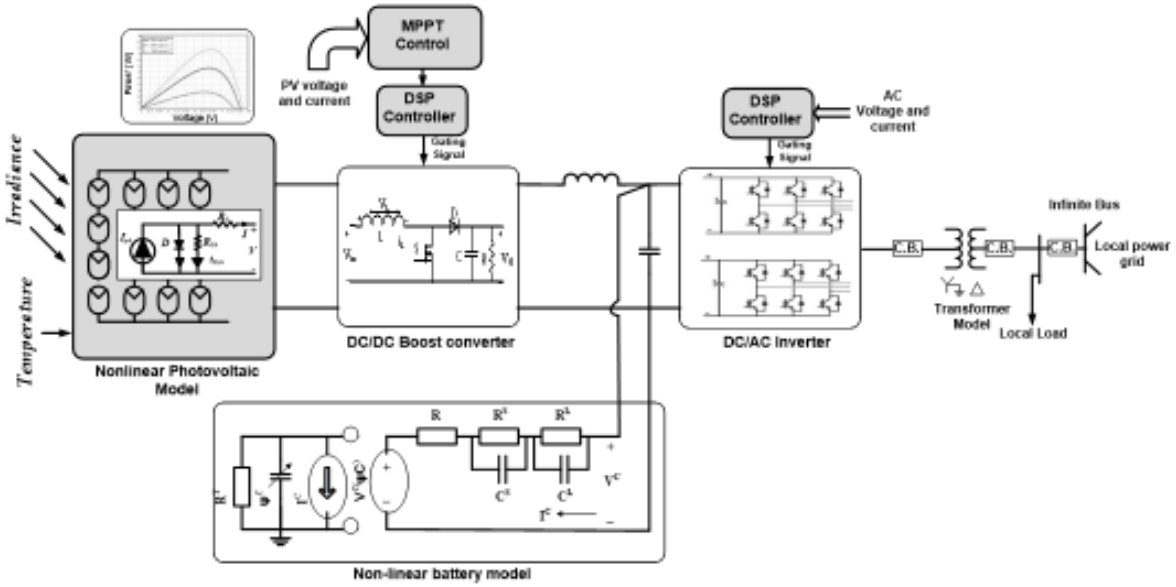

Fig. 20. A building microgrid control models for solar and storage systems.

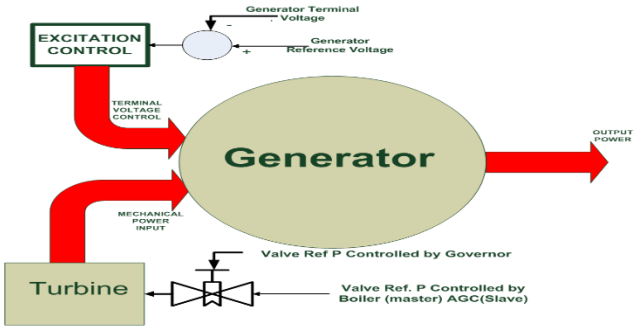

Fig. 21. The description of control of steam unit load frequency control systems.

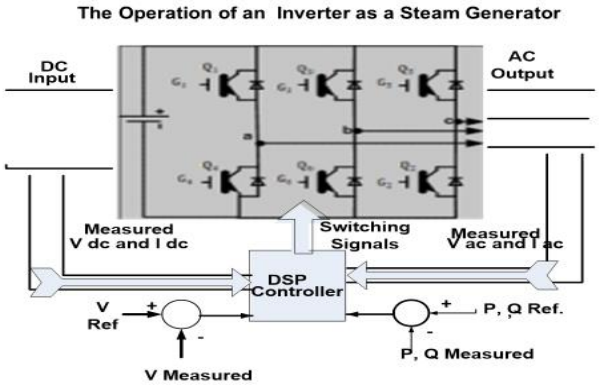

Fig. 22. Load frequency control and generation control.

of the inverter under control of DSP. In the microgrid, the control objectives are to maintain stable output voltage and elimination of third, fifth, seventh harmonics such that total harmonic distortion (THD) less than 5%. The third, fifth, and seventh harmonic degrade the life of Delta/Y transformers.

A simulation testbed was developed the operation of the proposed microgrid evaluated. The DSP experimental testbed was constructed for testing The LFC and generation is control by switching operation of the inverter under control of DSP. DSP maintained a stable output voltage. In the experimental

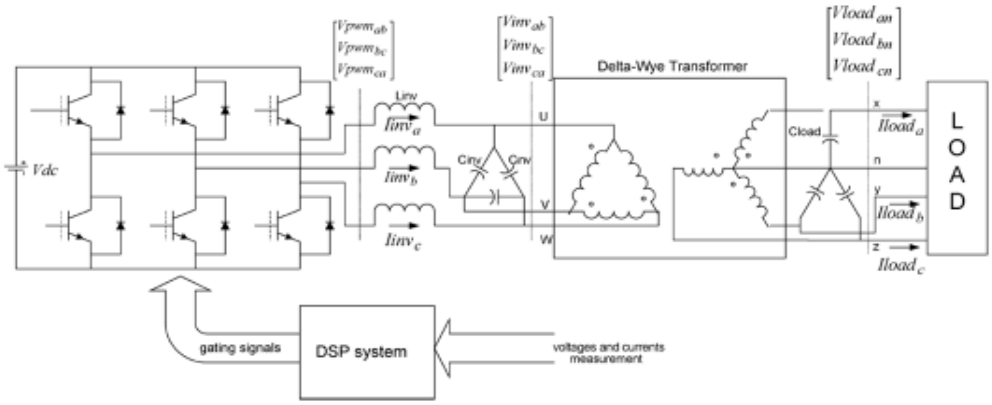

Fig. 23. DSP control of LFC.

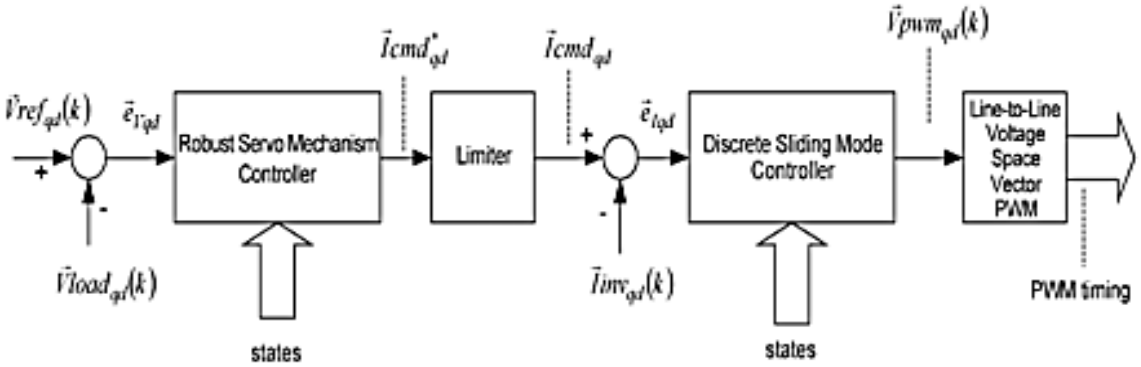

Fig. 24. The block diagram of microgrid control

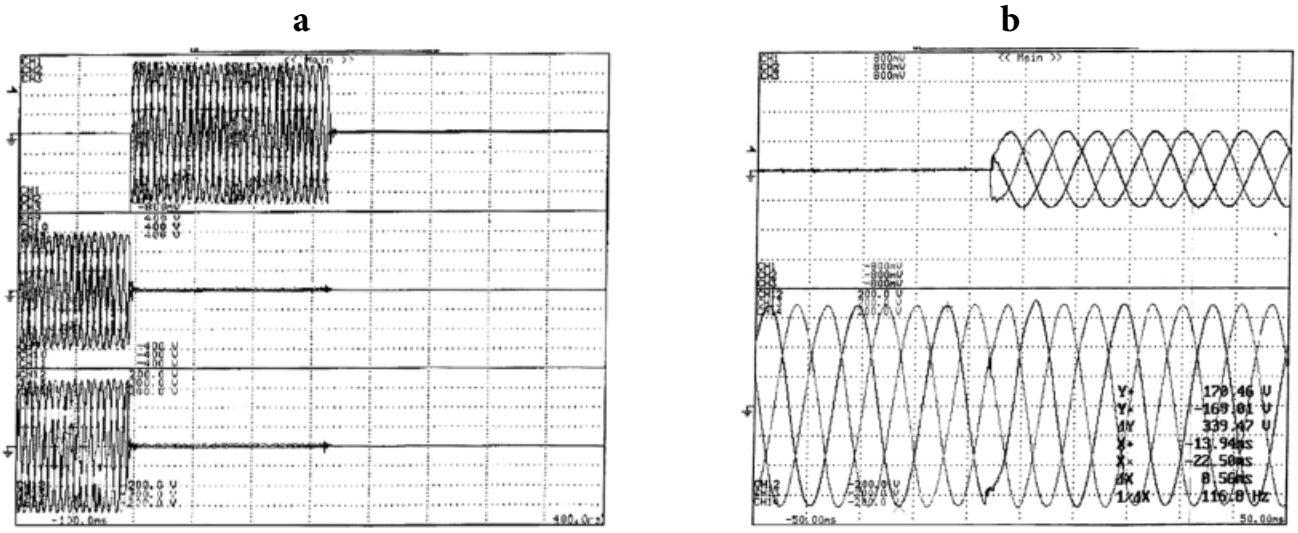

Fig. 25. A sample results of the microgrid control.

(a) Three-phase short-circuits on output terminals. Top: inverter currents, middle: load voltage, bottom: inverter voltages

(b) Resistive load transient: 0% to 100%. Top: three-phase load currents, bottom: three-phase load voltages resistive load transient

testbed, total harmonic distortion (THD) due to the third, fifth, seventh harmonic measured. It was established that the total harmonic distortion of less than 5%. The modeling and experimental analysis are presented in papers below: A sample results of the work.

B. AN applications to the power grid.

They are many applications of AN in the power grid, and a Google search will lead to the sources. The author has used AN in the synchronous machine and fuel cell modeling for capturing the nonlinear operation. The sample of these work presented below:

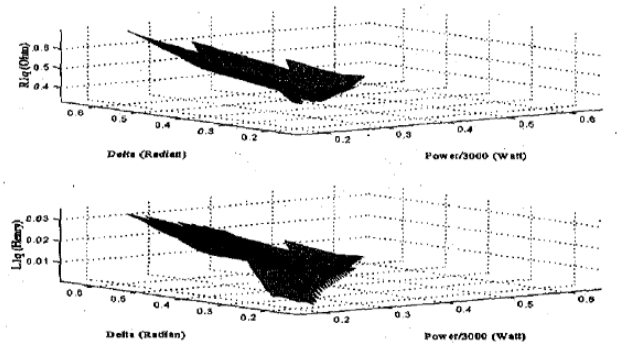

Fig. 26. Transfer function of R and L ANN models [4]

$$P = \left[Power/3000 \quad \delta \right]^T;$$
$$\theta_{r,est} = W_2 \cdot \tanh(W_1 \cdot P + B_1) + B_2$$

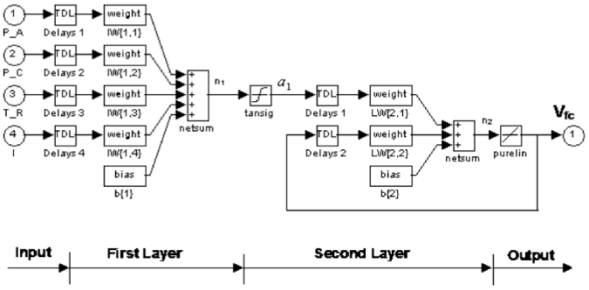

Fig. 27. Neural Network Model of the PEM fuel cell [5]

The lessons learned on the modeling of synchronous machines and other works published on AN shows that physical processes are nonlinear, and the process can be modeled if one can collect input and output data and uses AN for nonlinear modeling. The data acquisition is computerized, and computer storage is readily available. Today world power is in the hand of entities who have the data. All is about Data about why Google, Microsoft, Appal, and FaceBook are powerful companies. These companies collect our data the moment we used them. It is free for them, and they use our information. [6]

$$x = [(m_{O_2})_{net} \quad (m_{H_2})_{net} \quad (m_{H_2O})_{net} \quad T \quad P_{H_2} \quad P_{O_2} \quad P_{H_2O} \quad Q_C \quad Q_E \quad Q_L \quad V_C]^T$$
$$u = [u_{P_A} \quad u_{P_C} \quad u_{T_R}]^T \qquad w = [I]$$

and A and B shown at the bottom of this page,

$$y = \theta_7(x_4, x_5, x_6, x_7)$$
$$\theta = [\theta_1(x_4) \quad \theta_2(x_4) \quad \theta_3(x_4) \quad \theta_4(x_4) \quad \theta_5(x_7) \quad \theta_6(x_4, x_5, x_6, x_7) \quad \theta_7(x_4, x_5, x_6, x_7) \quad \theta_8(x_4, x_5, x_6, x_7)]^T$$
$$A_{44} = \left[\frac{-h_S n_S A_S}{M_{fc} C_{fc}} \right] \qquad A_{11\times 11} = \left[\frac{-1}{C(R^{Act} + R^{Conc})} \right]$$
$$G = \begin{bmatrix} \left(\frac{1}{4\lambda_C F}\right) & \left(\frac{1}{2\lambda_A F}\right) & \left(\frac{1}{2\lambda_C F}\right) \\ -\theta_8(x_4, x_5, x_6, x_7) & -\theta_2(x_4) & -\theta_4(x_4) \quad 2\theta_4(x_4) \\ \theta_6(x_4, x_5, x_6, x_7) & \theta_7(x_4, x_5, x_6, x_7) & 0 \quad \frac{1}{C} \end{bmatrix}^T.$$

$$A = \begin{bmatrix} \frac{-1}{\lambda_C} & 0 & 0 & 0 & 0 & 0 & 0_{1\times 4} & 0 \\ 0 & \frac{-1}{\lambda_A} & 0 & 0 & 0 & 0 & 0_{1\times 4} & 0 \\ 0 & 0 & \frac{-1}{\lambda_C} & 0 & 0 & 0 & 0_{1\times 4} & 0 \\ 0 & 0 & 0 & A_{4\times 4} & 0 & 0 & 0_{1\times 4} & 0 \\ 0 & 0 & 0 & 0 & -2\theta_1(x_4) & 0 & 0_{1\times 4} & 0 \\ 0 & 0 & 0 & 0 & 0 & -2\theta_3(x_4) & 0_{1\times 4} & 0 \\ 0 & 0 & 0 & 2\theta_5(x_7) & 0 & 0 & 0_{1\times 4} & 0 \\ 0_{2\times 1} & 0_{2\times 1} & 0_{2\times 1} & 0_{2\times 1} & 0_{2\times 1} & 0_{2\times 1} & 0_{2\times 4} & 0_{2\times 1} \\ 0 & 0 & 0 & (h_S n_S A_S) & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0_{1\times 4} & A_{11\times 11} \end{bmatrix}$$

$$B = \begin{bmatrix} 0_{3l} & 0_{3\times 1} & 0_{3\times 1} \\ 0 & 0 & \left(\frac{h_S n_S A_S}{M_{fc} C_{fc}}\right) \\ 2\theta_1(x_4) & 0 & 0 \\ 0 & 2\theta_3(x_4) & 0 \\ 0_{3\times 1} & 0_{3\times 1} & 0_{3\times 1} \\ 0 & 0 & (-h_S n_S A_S) \\ 0 & 0 & 0 \end{bmatrix}$$

1) Self-Learning

Today learning takes place outside of the classroom. Every subject we wish to learn can be self-taught. The role of a professor is effective when it is a coach and lead the student on how to analyze and define the steps in the learning process. How often, students sit in a classroom and daydream and count minutes until the lecture is over. We all know that many universities have lectures on their website. We need to self educate as we do research.

As an example, suppose we want to lean the AN modeling using Matlab AN toolbox. Consider an R-L circuit or a second-order differential equation. Then write the differential equation in the state-space model. For a set of an input record, the output. Now use the input data and output data to construct the AN model and compare the AN solution with a classical solution.

2) Reflection

Our home, the planet Earth, created around 4.54 billion years ago by accretion from the solar nebula that contains hydrogen with smaller amounts of helium, oxygen, sulfur, and other heavier elements. The oldest known sign for modern humans (as of 2017) are fossils found at Jebel Irhoud, Morocco, dated about 300,000 years old. Accidental genetic mutations changed the brains of Hmo Sapiens, modern humans, enabling them to think and to communicate using language. The fire was first used by humans about 230,000 years ago. Homo Sapiens started to migrate from East Africa roughly 60-70,000 years ago and spreading over the planet Earth. The Cognitive Revolution transpired between 70,000 to 30,000 years ago. It permitted humans to communicate talk about things we have never seen, touched, or smelled.

The First Agricultural Revolution is the transformation of human societies from hunting and gathering to farming occurred worldwide between 10,000 BC and 2000 BC. The Second Agricultural Revolution took place first in England in the seventeenth and early eighteenth centuries by the introduction of new crop rotation techniques and selective breeding of livestock. The Third Agricultural Revolution-began in the 1930s that introduce modern agriculture all over the world and eradicate starvation by improving the output and quality of crops. Brahmagupta, a scholar and mathematician in 628 C.E, defined zero and its operation in the decimal numbering system. -Khwarizmi introduces the decimal numbering system the 9th-century algebra by introducing the algorithm for solving the second-order equation to the world. He is known as the "father of algebra," a word drawn from the title of his book, Kitab al-Jabr. When Khwarizmi's work became renowned in Europe through Latin translations, his impact made an enduring mark on the growth of science in the West. His Algebra book pioneered that discipline of mathematic to Europe, unknown till then. Algebra turns into the standard mathematical text at European universities until the 16th century.

The emergence of modern science followed the Scientific Revolution during the early modern period around1550-1700 C.E. It began with Nicholas Copernicus's discovery of the sun-centered cosmos. In 1712 C.E, the first practical steam engine was invented by Thomas Newcomen. Steam would become an important source of power for the first Industrial Revolution. The Second Industrial Revolution rapid advances were made in steel production, electricity and petroleum. In the second half of the 20th century, a third industrial revolution launched the age of a new: nuclear energy and the rise of digital technology all over the world fundamentally changed the lives of humans. Right now, it's happening again, for the fourth time revolution is emerging with IoT, machine learning, data mining, and deep learning. We will see one more epochal event. We will vanish within a few centuries, either because we've gained such godlike powers as to become unrecognizable or because we've destroyed ourselves through environmental mismanagement.

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