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Vision

“To Establish Omnipotent Learning Centre Meeting the Standards to Evolve as a Lighthouse for the Society.”

Mission

- Setting up state-of-the-art infrastructure
- Instilling strong ethical practices and values
- Empowering through quality technical education
- Tuning the faculty to modern technology and establishing strong liaison with industry
- Developing the institute as a prominent center for Research and Development
- Establishing the institute to serve a Lighthouse for the society

Quality Statement

“We, Matoshri College of Engineering & Research Center are committed to practice a system of Quality Assurance that inculcates quality culture, aiming at quality initiation, sustenance and enhancement of quality comprehensively ultimately leading the institute as Center of Excellence.”

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Rainwater Harvesting

Mrs. S. T. Borole, Civil Engineering Department

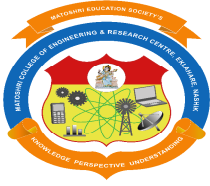
Rainwater harvesting (RWH) is the collection and storage of **rain**, rather than allowing it to run off. **Rainwater** is collected from a roof-like surface and redirected to a tank, cistern, deep pit (well, shaft, or borehole), aquifer, or a reservoir with percolation. Rain water harvesting is the collection of rainwater into the man made resources or any natural resource like pond, lake, etc at the same place where it falls from rooftops or ground. Two main techniques of rainwater harvesting are storage for future use and recharge into the ground. It can be used for crop harvesting, gardening, toilets, etc. Following are the benefits of rainwater harvesting at individual or city-wide level. It helps in reducing the water supply bills especially to the institutions. Rainwater recharged to the ground positively affects



groundwater quality by diluting fluorides, nitrates and its salinity. It contains almost neutral pH and zero hardness which makes it more able to be used in homes, industries, institutions and other commercial establishments. It may reduce the stress of public water supply sources. Recharge of rainwater to the ground prevents sea-water immersion into the fresh water bodies in the coastal areas.

It helps in controlling urban flooding if people do rainwater harvesting from rooftops. It reduces water demands of people from the municipality thus lessens energy consumption too in distributing water all through the city.

Rainwater harvesting has been known and widely practiced for many centuries, especially during the dry season for a different purpose. The increase of agricultural economy of the country is extremely exposed to weather and climate effects. Decrease of crop production in dry areas is linked to the water (runoff, evaporation and overindulgence use). The objective of this article is to review the status of rainwater harvesting (RWH) technology and practices in sustaining agricultural production., therefore practicing water harvesting and supplying improved water harvesting technologies providing extended



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service regularly for farmers should be practiced in the future. Therefore, from the point of view of water conservation, both internal and external catchment-based RWH had the eminent potential of mitigating rainfall-related crop

Rainwater harvesting systems consists of the following components:

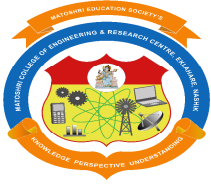
- Catchment- Used to collect and store the captured Rainwater.
- Conveyance system – It is used to transport the harvested water from the catchment to the recharge zone.
- Flush- It is used to flush out the first spell of rain.
- Filter – Used for filtering the collected Rainwater and remove pollutants.
- Tanks and the recharge structures: Used to store the filtered water which is ready to use

The process of rainwater harvesting involves the collection and the storage of rainwater with the help of artificially designed systems that run off naturally or man-made catchment areas like- the rooftop, compounds, rock surface, hill slopes, artificially repaired impervious or semi-pervious land surface.

Several factors play a vital role in the amount of water harvested. Some of these factors are:

- The quantum of runoff
- Features of the catchments
- Impact on the environment
- Availability of the technology
- The capacity of the storage tanks
- Types of the roof, its slope and its materials
- The frequency, quantity and the quality of the rainfall

The speed and ease with which the Rainwater penetrates through the subsoil to recharge the groundwater. Rainwater harvesting is a sustainable process that helps in preserving water for future needs. Water scarcity is a major concern in today's scenario. The process of rainwater harvesting is a good way to conserve water. Due to rainwater harvesting system benefits in Less cost, Helps in reducing the water bill, Decreases the demand for water, Reduces the need for imported water, Promotes both water and energy conservation, Improves the quality and quantity of ground water, Does not require a filtration system for landscape irrigation. This technology is relatively simple, easy to install and operate. It reduces soil erosion, storm water runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments. It is an excellent source of water for landscape irrigation with no chemicals and dissolved salts and free from all minerals.



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Potential use and benefits of automation for traffic control in roadway construction

Mr. R. R. Kshatriya, Civil Engineering Department

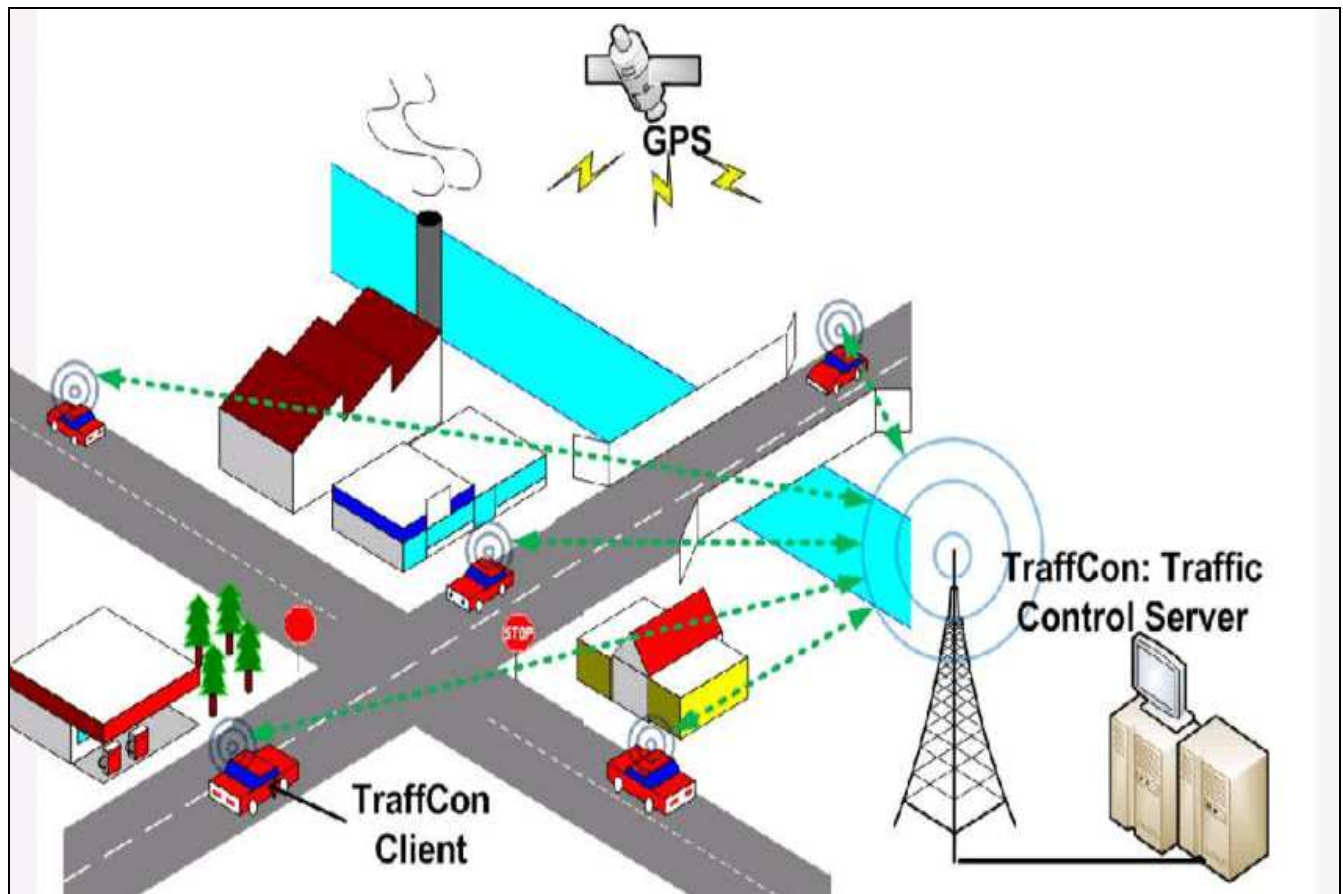
Automation and robotization of the construction activities have been studied by many researchers in order to enhance work productivity and improve workers' safety (Bock, 2015; Cai et al., 2019; Chui and Mischke, 2019; Lundeena et al., 2019). Although different in many ways, one may expect the construction industry to follow a path to automation similar to the one that took place in the manufacturing industry (Kahane and Rosenfield, 2004; Warszawski and Navon, 1998). A literature review shows that the repetitive and the more risky construction activities are good candidates for automation (Wetmore and Alemany, 2019; Paull, 2020). One of such activities is flagging during road construction. If the use of automated devices proves as effective as the traditional methods, then the workers' interest will also be served by eliminating an activity known for being among the highest risky activities in work zone. This can be proven by confirming that drivers respond appropriately to automated systems as they do to the construction flaggers common in today's road construction zones.

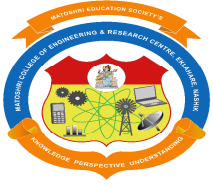
To study the efficacy of automating the flagging activity, drivers' responses to the use of automated traffic control devices were recorded and analyzed. An experiment was conducted to measure when, how often, and for how long a driver would observe the various objects (that is, items, areas, devices, and aspects) when approaching roadway construction zones. The study utilized an open-source eye tracking software to collect the data. The software was developed by XLabs (xlabsgaze.com) as a Google Chrome Extension, and it works on any computer with Google Chrome browser and a webcam. In this study, the software was used to determine the first moment each driver noticed the different objects (that is, items, areas, devices, and aspects) of a construction zone scene, as well as, to track how long he/she focused on each object in the different work zone scenarios. The drivers were also surveyed afterwards to determine their level of comfort in each scenario. The data collection was based on tracking the eye movements of the viewer and measuring the duration the viewer focused on a given object. The viewer was provided construction zones equipped by automated sensors or construction flaggers. The construction zones represented work conditions during daytime and during night hours. The objective was to determine which system/device/ approach was better in attracting the driver's attention as he/she approached a roadway construction zone. The sequence of displaying the construction work zones was randomized to eliminate the possible influence of conditioning the drivers by following a certain sequence. Upon the completion of the viewing session, each viewer was requested to complete a questionnaire to capture the post-viewing feelings concerning the use of automated signals and the use of human flaggers in roadway construction. The total time required for completing a viewing session and the questionnaire was about 10-15 min.

This study addresses the impact of using automated flagging devices in road construction instead of using construction workers. To examine the efficacy of automating this construction activity, a group of drivers with diverse characteristics/demographics was involved in the study. The diverse characteristics included gender, age, years of driving experience, and level of formal education (e.g., high school, college, and graduate degrees). Each participant was requested to view road construction scenarios involving the use of traffic control means/devices. The participants were requested to complete a questionnaire after viewing the scenarios to determine the drivers' perceptions (that is, comfort/discomfort) in each scenario. The scenarios were displayed on a computer, and an eye-tracking software was used to determine where drivers focused their attention as they approached the road construction zones. During the viewing of the scenarios, the eye-tracking software recorded the driver's

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eye movements, determined the screen coordinates where the driver was looking, and noted the time spent at each coordinate. The results did not show significant differences in the drivers' perceptions for the use of traditional flagging methods and the automated ones. However, the traditional methods (that is, involving labor) scored higher on the visibility questions, and the automated systems were judged more effective by younger drivers. Moreover, the use of automated systems did not present any noteworthy obstacles for construction companies in implementing traffic control plans during roadway improvements or repair.





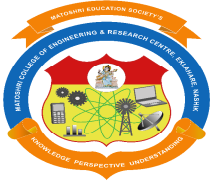
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Reliability assessment of progressive failure of a low rise framed building on weak soil-foundation interaction

Priyanka Waykar, B.E. Civil

A 4-storey reinforced concrete framed buildings was modelled in 3-dimensional analysis with the same sections and loadings for both rigid and weak foundations respectively using ETABS and FORM5 Software in accordance with Euro code provisions. The weak foundation was initially analysed and designed as a fixed column-foundation joint and later re-analysed and redesigned as a hinged column foundation joint. The ETABS software was used to obtain the most critical component member forces and bending moments while FORM5 software was used to obtain the reliability indexes. The results revealed that due to the effect of weak soil safe bearing capacities, allowable maximum displacement was exceeded resulting in lower predicted reliability indexes and higher probability of failures that enhanced progressive failure. The reliability index recommended by Euro code was not achieved due to the effect of weak soil-structure interactions which showed that it will be very disastrous if rigid soil structure interactions were assumed for a weak soil safe bearing capacities. The use of a hinge column foundation joint for structural analysis will produce increased sections and reinforcement areas in reinforced-concrete frames. These would consequently improve the reliability indices of structures built on weak soils and reduces its probability to fail. Therefore, it was concluded that, a hinged joint should be adopted as column-foundation connection when the soil is generally weak. The findings of this study would be a useful guide and reference materials for structural safety and reliability analysis with regards to variation of soil type.

Schulze (1943), a prominent historical figure in soil mechanics and foundation engineering in Germany, stated in 1943 that “For the determination of allowable bearing pressure, the geophysical methods, utilizing seismic wave velocity measuring techniques with absolutely no disturbance of natural site conditions, may *Corresponding author. Email: ketkukaht@unijos.edu.ng Author(s) agree that this article remain permanently open access under the terms of the Creative Commons Attribution License 4.0 International License 42 J. Civ. Eng. Constr. Technol. yield relatively more realistic results than those of the geotechnical methods, which are based primarily on borehole data and laboratory testing of so-called undisturbed soil samples. Therefore, Tezcan and Ozdemi (2011) based on a variety of case histories of site investigations, including extensive borehole data, laboratory testing and geophysical prospecting at more than 550 construction sites, an empirical formulation is proposed for the rapid determination of allowable bearing pressure of shallow foundations in soils and rocks. The proposed expression collaborates consistently with the results of the classical theory and is proven to be rapid, and reliable. Plate load tests have been also carried out at three different sites, in order to further confirm the validity of the proposed method. It consists of only two soil parameters, namely, the in situ measured shear wave velocity and the unit weight. The unit weight may be also determined with sufficient accuracy, by means of other empirical expressions proposed (Tezcan and Ozdemi, 2011). According to Halabian et al. (2003), statistics and probabilistic analyses and risk assessments can be very useful decision-making tools when dealing with structuralgeotechnical problems. Wind loads, dynamic properties of soil underneath the structure and material characteristics of the structure are important factors that affect the wind action on the structure and consequently the structural wind-induced response. The main associated uncertainties that are very useful in the estimation of these factors are human error or inherent variability criteria which are at the forefront for the use of reliability approaches to evaluate the risk of failure during the service period of the structure under consideration. They performed the probabilistic base force analyses for the tall structure; the substructure approach in which

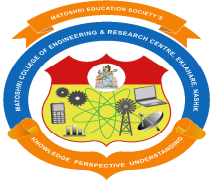


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the soil supporting the foundation is modelled by the foundation compliances as functions of soil shear wave velocity is used to account for the soil–structure interaction efficiently.

A three main variable probabilistic approach is used to account for the uncertainties in shear wave velocity of the soil underneath the foundation, the concrete strength and the design wind speed on the calculated response and the base forces (Halabian et al., 2003). The result of the investigation show that the dynamic response of the tower increases as soil shear wave velocity decreases. For the range of soil shear wave velocity encountered in practice, the base forces of the structure may increased by up to 20% as a result of the foundation flexibility. For the limit state considered in this study, it was found that the reliability index decreases by up to 15% and the probability of failure increases by up to one order of magnitude as a result of the soil–structure interaction effect (Halabian et al., 2003). Jihong and Liqiang (2018) defined the failure or damage of a structure as consisting of a series of failure incidents, including the transition from rigid joints to pinned ones and component fractures. They used the Improved Structural Vulnerability Theory (SVT) in which failure processes of essential components is defined according to damage characteristics of their ductile and brittle members. The improved method accurately identified possible collapse mode of steel moment frame because of the transformation processes of the failure of a 4-storey steel framed building. The collapse mode caused by failure scenarios near the joints in the bottom story had the maximum vulnerability index. Therefore, such a failure mode should be avoided during structural design because the first story is likely to be the weakness or the weakest link for the point of unzipping of the structure which could trigger collapse mechanism.

On the other hand, the collapse mode with a ‘beam plastic hinge’ failure as the expected failure mode had the minimum vulnerability index. Thus, the improved method theoretically verified the rationality of the seismic design concepts of ‘strong-joint weakmember’ and ‘strong-column weak-girder’, as found in the codes of different countries (Jihong and Liqiang, 2018). Jiang et al. (2019) similarly used the Improved Structural Vulnerability Theory (ISVT) to analyse a pedestrian bridge on the campus of Florida International University (FIU Bridge) that collapsed during construction, and 6 victims were identified in this disaster event. By comparing the collapse mode identified by ISVT and the actual collapse scenario of the FIU Bridge, it was found that ISVT could effectively identify the weakness and predict the possible collapse modes of the FIU Bridge by a quantitative vulnerability index. Then, parametric analyses were conducted for the bridge to different unforeseen damage events, and the collapse mechanism of the failure characteristics of the FIU Bridge is also revealed by the ISVT. The result show that, if a component of the FIU Bridge is damaged in an unforeseen damage event, the maximum vulnerability index would be increased 10~419%. The increments are more obviously for the cases that the damaged component is located at mid-span. Once one of these components is damaged, the maximum vulnerability index of the bridge is increased dramatically. Thus, these key components should be properly designed by the researchers and engineers, both in construction stage and servicing stage. It is also recommended that to avoid the relative slender components, rigid frame bridges should be designed because the relative slender components would be easily buckled if an unforeseen damage event occurred. Once these components damaged, the collapse risk of the bridge would be increased uncontrollably (Jiang et al., 2019). Wang et al. (2010) describes reliability as the ability of a system or component to function under stated conditions for a specified period of time. The term reliability, in an engineering sense, refers to the probability that a structure will not reach one or several specified.



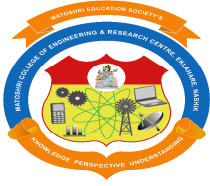
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Enhancing the strength of sandcrete blocks using coarse aggregates

Sweta Walunj, B. E. Civil

This current article explores the possibility of adding aggregate (10 mm size) to sandcrete mixes in order to enhance the strength of the sandcrete blocks. Four different kinds of mixes were made; the first one was used as a reference without the addition of coarse aggregate, and in the remaining three, coarse aggregates were added in percentages of 5, 10 and 15% by volume of the reference mix. Laboratory experimental tests were carried out in order to obtain the compressive strengths of the blocks moulded at 14, 21 and 28 days, respectively. The results of the tests revealed that the higher the percentage coarse aggregate content in the mix, the higher the compressive strength of the blocks. The improvement in the compressive strength was 12.78% more

Countries like Ghana, which is developing needs a lot of infrastructural expansion as it plays a pivotal role in her economic development. The needed physical infrastructural development cuts across all facets, like industrial buildings, commercial buildings, engineering projects and the housing stocks. In fact, these developing countries are facing the challenge of decreasing their housing deficits. Both the formal and informal sectors provide for housing needs especially in Ghana, Anosike and Oyebade (2012). Walling elements in this infrastructure are mostly done using sandcrete blocks. Baiden and Tuuli (2004) attest to the fact that sandcrete blocks are widely used as walling units in Ghana. Anosike and Oyebade (2012) reinforce this assertion by stating that sandcrete blocks are used in over 90% of physical infrastructures in Nigeria. In Ghana, sandcrete blocks as masonry units in assemblages of walls are used either as load bearing or non-load bearing walls. In most cases they are used in both the substructure and super structure of buildings especially in the urban centers or dwellings where demands for housing units are on the ascendancy. It is expected of these sandcrete blocks to perform their intended functions in structures whether they are serving as load bearing wall units or non-load bearing wall units. In recent years, there has been much concerns about the strength of the sandcrete blocks produced and used as walling units in the construction sector both (formal and informal) in Ghana. According to Kolovos et al. (2015), sandcrete blocks can only be acceptable for construction only when they are properly manufactured with good compressive strength and high bulk density. Studies on the compressive strength of sandcrete blocks are numerous; their findings suggest that sandcrete blocks are not meeting their expected strengths (Baiden and Tuuli, 2004; Anosike and Oyebade, 2012; Ngugi et al., 2014). Some researches like Chindaprasirt et al. (2005), Saraswathy et al. (2002) and Manikandan and Ramamurthy (2007) explored the magnitude of the effects of the continuous usage of constituents of sandcrete and concrete blocks on the environment and recommended the need for alternative materials or reduction in the use of them to safe guard the environment. The rapid growth in infrastructural development has led to an increase in the demand for sandcrete block. This in effect has consequently increased the demand for Ordinary Potland Cement (OPC) since cement is the main constituent in sandcrete block production yet it is expensive. OPC, as a constituent of the sandcrete blocks plays a vital role in the strength.



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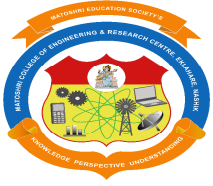
However, the cost of the cement especially in Ghana keeps rising day by day mainly because of the imported components such as clinker and the method of manufacturing which depends on electricity. For instance, the Saturday February 22nd of 2003 issue of the „Daily graphic page 14, the president of Ghana Institute of Engineers (GhIE) expressed concern about over-reliance on the use of foreign materials in the building industry, adding that “in the year 2000 alone Ghana imported hundred million dollars” worth of clinker for cement production”. Currently Ghana imports clinker and even OPC from outside the country for her construction industry. Rajdev et al. (2013), compares the use of Pozzolana cement, fly ash blended cements as alternatives to OPC. In the light of all these, it is important to find an effective way of enhancing the strength of sandcrete blocks without necessarily increasing the cement content. This work seeks to do this by introducing a percentage of coarse aggregates into the mixture of the sandcrete blocks. The objective of the study was to find out whether the strength of the traditional sandcrete blocks could be enhanced without necessarily increasing the cement content by introducing a percentage of coarse aggregates in the batching of the constituents of the sandcrete blocks.

Samples of the traditional sandcrete blocks were prepared and tested for compressive strengths, using a mix proportion of cement to sand aggregate ratio of 1:12. In all four different kinds of mixes were made; the first one was used as a reference without the addition of course aggregate, and in the remaining three, course aggregates were added in percentages of 5, 10 and 15% by volume of the reference mix. Laboratory experimental tests were carried out in order to obtain the compressive strengths of the blocks moulded at 14, 21 and 28 days, respectively

*If all the internet's
In all the world
Crashed to their deaths
And never came back up
How many suicides
Would this make?*

*If all the families
In the world
knew for certain
The internet
Was never coming back up
How many family murders
Would happen?*

*If all the cell phone towers
in the world
broke all communications
Would there be any
reason to live at all?*



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Recent advances in non-destructive testing of concretes and structures: An outlook

Mr.P. S. Sathe, Civil Engineering Department

Non Destructive Testing (NDT) of materials and structures is one of the most common forms of quality control. The Nigerian infrastructure systems continue to deteriorate due to lack of integrity checks on some identified projects in both public and private sector. Analysis of various sectors in Nigeria revealed that there are abandon projects in building and constructions industry while major oil and gas facilities projects have been put in hold due to political instability and corruption, and lack of capacity development in research and development amongst others. Opportunities arising from the adoption of specialist approaches such as the Internet of Things (IoT) solutions and Artificial Intelligence (AI) are being understood and embraced in industries by many companies to extend the use of conventional NDT to advanced validated NDT methods and beyond. This study highlighted the steps used in choosing an effective NDT methods in the industry, introduced briefly the current approaches and methods adopted for structural integrity management of concretes, challenges faced in the industry due to lack of utilization of NDT methods including an outlook and future of NDT technology in the industry. It is expected that the study will stimulate innovative research and technology transfer aimed at bolstering the performance of NDT in the management of critical national assets.

Over the last few decades, a lot of work has been done regarding infrastructure monitoring, inspection, repair and design code specifications. Maintaining safe and reliable civil infrastructures for daily use is important for the wellbeing of mankind. Operation and maintenance have become more complex with the increased age of the structures. Health monitoring is the process of determining and tracking structural integrity and assessing the nature of damage in a structure (Rehman et al., 2016; Chang et al., 2003). Concrete degradation, steel corrosion, change in boundary conditions, and weakening of connections in structures over time are major concerns in most civil engineering structures. If a damaged bridge remains unattended, the structural integrity and service capability of the bridge would deteriorate over time thereby necessitating frequent condition assessment and health monitoring of the system (Islam et al., 2014). Therefore, the safety, reliability and integrity management of these systems are very important to ensuring resiliency in their operations. The Nigerian economy is heavily dependent on the effective operation of these critical assets.

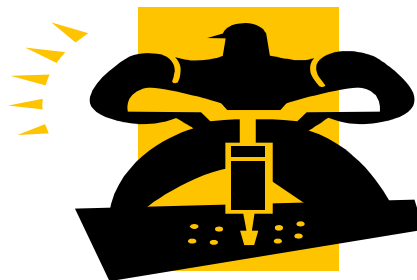
When they do not have the robustness and integrity to perform their operations under uncertainties, they would fail leading to the disruption of their operations with long term consequence. Therefore, these critical assets are analyzed in terms of their interdependences which include infrastructure systems' characteristics, operational relationships, environmental impacts, technical efficiency, failure types and states of operations that provide insight into the complexity of the systems while enabling a collaborative modelling to take place. The integration of NDT techniques and risk assessment tools is seen as an efficient method of managing safety and ensuring performance effectiveness of these assets. In light of the above, the aim of this paper is to carry out brief review of NDT methods used in the industry, highlight the defects and quality assurance issues associated with concretes, highlight challenges faced in the industry due to lack of NDT utilization, present risk governance of this critical infrastructure and present future outlook of NDT in concretes for structural integrity management.

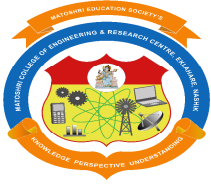
NDT METHODS USED IN THE INDUSTRY NDT technology was used in the industry as a quality control tool with the details of their processes set out in standards. The various methods of NDT were accepted because they could demonstrate their capability in practice through flaw detection of pores,

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cracks, inclusions, lack of fusion amongst others. Experience has shown that the type and size of the defect is a major factor for the NDT method to be deployed. The steps for choosing an effective NDT method are (Shull, 2002): (1) Understanding the physical nature of the material property or discontinuity to be inspected (2) Understanding the underlying physical processes that govern the NDT methods (3) Understanding the physical nature of the interaction of the probing field with the test material (4) Understanding the potential limitations of the available NDT technology (5) Considering economic, environmental, regulatory and other factors There are several emerging NDT methods which are validated and classified into conventional and advanced methods. Each of the methods has its peculiar characteristic advantages and limitations (Duaka, 2016). In order to ensure conformity to quality management of engineering systems, codes, regulatory requirements, standards, specifications and recommended practices are used in all aspects of construction, fabrication, manufacturing and inspection. While codes provide a set of rules that specify the minimum acceptable level of safety for manufactured, fabricated or constructed objects. Standards are documents that establish engineering or technical requirements for products, practices, methods or operations. Examples of codes used in the oil and gas industry are the ASME Boiler and Pressure Vessel Code (B&PVC).

The AWS D1.1 Structural Welding Code – Steel and that of certification standards are the ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Non-destructive Testing Personnel and the ANSI/ASNT CP-105, ASNT Standard Topical Outlines for Qualification of Nondestructive Testing Personnel (ASNT, 2019). Other commonly test methods used for concretes are Standard Test Method for Pulse Velocity through Concrete ASTM C597-16, ASTM C805 and EN12504-2:2001 for Rebound Hammer, ASTM C597, EN12504-42004 for Ultrasonic Pulse Velocity (UPV) amongst others (Hannachi and Guetteche, 2012). Conventional NDT techniques The validated conventional methods are techniques that have developed over time and presently have been documented in codes, standards and best practices. Based on industrial application, the setup and procedure of the conventional technique is typically simpler in comparison to advanced methods. These methods are summarised as follows (Duaka, 2016): (1) Acoustic Emission Testing (AET) (ii) Leak Testing (LT) (iii) Electromagnetic Testing (ET) (iv) Thermal/Infrared Testing (TIR) (v) Neutron Radiographic Testing (NRT) (vi) Liquid Penetrant Testing (LPT) (viii) Magnetic Particle Testing (MPT) (ix) Radiographic Testing (RT) (x) Ultrasonic Testing (UT) (xi) Vibration Analysis (VA) Advanced Validated NDT Methods: The advanced validated NDT methods include the following: (1) Phased Array Ultrasonic Testing (PAUT) (2) Alternating Current Field Measurement (ACFM) (3) Long Range Ultrasonic Testing (LRUT) (4) Guided Wave Ultrasonic Testing (GWUT) (5) Pulse Eddy Current Testing (PET) (6) Digital Radiography Testing (DR) (7) Time of Flight Diffraction Testing (TOFD)



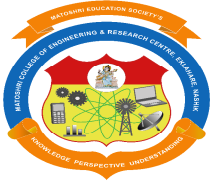


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Formation On-Cancellation of Current Harmonics In Three Phase Four Wire System Using Smart Filter

Ms. Sonali Pawar , ME Power System First year

Current harmonics in distribution grids largely result from the widespread usage of nonlinear masses. Discharge lamps and power-electronics-based equipment's area request samples of nonlinear masses in residential, commercial, and industrial facilities. Currents harmonics even have a major result on medium-voltage (MV) and 55 networks. Harmonics area unit number multiple of elementary frequency(i.e. fifty or sixty Hz) element that more along resulted in distorted wave. maybe second harmonic is 2 time of elementary (i.e. one hundred or one hundred twenty Hz), equally for third harmonic it's thrice of the elemental element (i.e. a hundred and fifty or one hundred eighty Hz) then on. Thanks to extreme use of power converters and alternative non-linear masses in business it's ascertained that it deteriorates the facility systems voltage and current waveforms. Static power converters admire single phase and 3 section rectifiers, thermal resistor converters and huge variety of power equipment area unit nonlinear masses that generate appreciable disturbances within the ac mains. primarily voltage harmonics and power distribution issues arise thanks to current harmonics made by nonlinear masses. As nonlinear currents ow through electrical system and therefore the distribution-transmission lines, extra voltage distortion manufacture thanks to the resistivity related to the electrical network. The presence of harmonics within the power grid cause bigger power loss in distribution, interference downside in communication system and, typically end in operation failure of electronic equipment's that area unit additional and additional sensitive as a result of it contains electronics controller systems that work with terribly low energy levels. It's noted that non-sinusoidal current ends up in several issues for the utility power offer company, admire low power issue, low energy potency, magnetism interference (EMI), distortion of line voltage etc. Passive filters are used as an answer to unravel harmonic current issues, however owing to the many disadvantage of passive filter love it will mitigate solely few harmonics and offers rise to resonance downside. in addition, passive filters have disadvantage of bulk size .To influence these blessings, recent efforts are focused within the development of active filters, that area unit able to compensate not solely harmonics however additionally uneven currents that is caused by nonlinear and unbalanced masses. owing to the exceptional progress within the last 20 years within the field of power physical science devices with forced com-mutation, active filters are extensively studied and an oversized variety of the works are revealed. There area unit essentially 2 forms of active filters: the shunt sort and series sort. Shunt connected active power filter, with a self-controlled dc bus used for reactive power compensation in power transmission systems. Shunt active power filters compensate load current harmonics by injecting equal-but opposite harmonic compensating current. Series active power filters were introduced by the tip of the Nineteen Eighties and operate primarily as a transformer and as a harmonic isolator between the nonlinear load and therefore the utility system. The series-connected filter protects the buyer from AN inadequate offer voltage quality. The series active filter injects a voltage element nonparallel with the provision voltage and so may be thought to be a controlled voltage supply compensating voltage sags and swells on the load facet. Until currently several management ways are developed however fast active and reactive current (id-iq) element methodology and fast active and reactive power (p-q) methodology area unit additional common ways. This primarily concentrates on these 2 management ways (id-iq and p-q) with PI controller. Each ways area unit compared beneath distorted main voltage condition and it's found that id-iq management methodology deliver the goods superior harmonic compensation performance. The id-iq management is predicated on a synchronous rotating frame derived from the mains voltages while not the utilization of a phase-locked loop (PLL).By the id-iq management methodology several synchronization issues area unit avoided and a really frequency-independent filter is achieved.



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Dissolved Gas in Transformer oil detection methods

Ms. Neha Mahaja , ME Power System

The subject of transformer maintenance is very important as it affects the electric grid economically and also the grid efficiency. It is very important that the grid should be able to provide uninterrupted power supply to the consumers. For such a power supply it is required that the transformer should be reliable. Some major faults can occur in the transformers which may lead to reduction in the transformer's efficiency and reliability. So it is very important that the fault should be detected in an early stage so that it is possible to take the required preventive actions. Some of traditional test techniques used for oil conditioning monitoring are Break-down voltage measurement, tan delta, moisture content, resistivity, inter-facial tension and oxidation stability. Therefore transformer monitoring is needed to avoid costly outages and interruption in power supply. Some of the major faults that could occur in the transformer are arcing, corona discharge, low energy sparking, severe overload and overheating in the insulation system. Transformer monitoring is very important to detect early signs of its malfunction so that we can find a solution for it as soon as possible. The transformer monitoring has a major role to play to check whether the equipment is reliable and to ensure that the equipment operates properly over their whole lifespan and that equipment mal-operation is avoided. The health of the equipment is surveyed through the measurement and testing of parameters which may vary.

There are various monitoring techniques which are currently used for detecting faults in transformers. Some of the main methods are Dissolved Gas Analysis (DGA), Partial discharge monitoring, Temperature Profile, Furfural Analysis. The possible faults which can occur in transformers are partial discharge, overheating, arcing, thermal and electrical faults.

Temperature Profile

One of the main sources of the generation of heat in transformer is the current owing through the conductors. Other sources of heat include the heat generated due to the faults occurring in them. Temperature monitoring is used to continuously check the temperature profile of transformer, and to find out whether it is exceeding the limits or not. Thermo-vision scanning which makes the use of infrared scanner is used to monitor the temperature of the transformer locally. Also it can be found out whether hotspots are present using local temperature monitoring which makes use of thermocouples and Resistance Temperature Detectors (RTDs) and optical sensors.

Monitoring & Measurement of Partial Discharge

Solid and liquid insulation is used in the transformers. The gas bubbles may be produced in the liquid insulation and voids can be produced in the solid insulation and metallic particles. The increase in the level Partial Discharge (PD) or the rising PD activity gives a possible indication of the developing incipient faults. The sensors used for Partial Discharge monitoring are a base for broadly classifying the PD monitoring techniques. The two categories are the electrical method and the acoustic method. These methods are again further classified into two sub categories viz. the intrusive and the non-intrusive method depending upon the sensors used in them.

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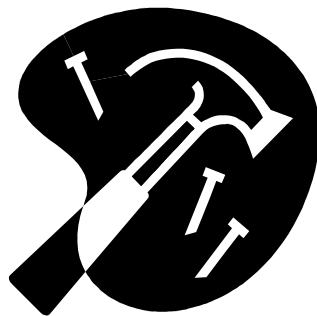
The sensors which are installed outside the transformer are called non-intrusive sensors. Some of the examples of such sensor are coupling capacitors, high frequency current transformers (HFCT). These sensors are at a low risk as they are placed outside the transformers than the intrusive sensors which are placed directly inside the transformer. One of the example of such a sensor is the fiber optic sensors. Handling the interferences is a major issue with the electrical PD monitoring. There is an emerging trend of the acoustic PD monitoring technique. In this type of monitoring accuracy in finding the PD location is required. Again there are many factors which affect the acoustic velocity such as gas and water contents in oil, temperature of oil.

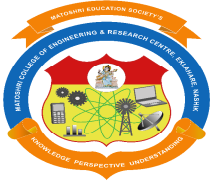
Furan Analysis

The decomposition of cellulose paper insulation occurs due to the fault in the transformer or elevated temperatures. This leads to the production of gases like CO and CO₂. These gases can be detected by a test called the Furfural Analysis which is also called as high performance liquid chromatography (HPLC). The test is carried out as per IEC-61198. The stable products like 2-furfural, 5-Hyd Methyl 2 furfural, 2-furfuryl Alcohol, 5-Methyl

Dissolved Gas Analysis

The power transformers use insulation like paper, pressboard, and mineral oil. Thermal and electrical stresses are always happening in the transformer. The insulation materials get degraded because of these reasons. These stresses lead to the formation of gases which afterwards get dissolved in oil. The gases which are generated are the first possible indication of mal-operation. DGA is the most effective tool for determining the health of the transformer. Among the methods available for transformer monitoring Dissolved Gas Analysis is more popular for informing about the fault occurring in the transformer. A small quantity of sample is required from the oil to identifying the fault. It is required that the sample should be carefully taken so that evading of gases is prevented and loss of hydrogen is also minimized. Different patterns of gases are generated depending on the severity of fault. There are various ratio methods used for Dissolved Gas Analysis such as the key gas method, ratio methods such as Dornenberg, Roger's, Cigre recommendations and the IEC 60599.





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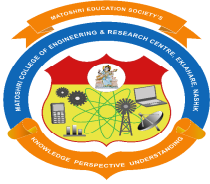
Advanced Control of Wind Turbine to Achieve Higher Power Output

Mr. Joydeep Sarkar , ME Power System

The world is searching for solutions to many environmental problems that the planet faces today. But this requires long-term potential actions towards sustainable development. The energy department of all the nations are looking towards renewable energy resources as one of the most efficient and effective solutions available now. Renewable energy is developed because of the environmental problems and fossil-fuel exhaustion. Compared to renewable energy sources like solar energy, the installation of wind energy systems are to the costly. The power generation using wind energy is possible in two ways, constant speed operation and variable speed operation using power electronic converts. The viability of wind as an optimum source of power is seen as a commercially successful. Wind turbines are designed which can generate power at a reasonable wind speed of 4-6 m/s, though the amount of power generated may vary from the rated ally, wind turbines can be seen having two basic configurations, the _xed speed operation & variable speed operation. Different wind generators are designed for both the designs, each having their own advantages and disadvantages. One major drawback seen in the case of fixed speed turbine is the use of gears to maintain the revolutions to provide synchronous speed to the synchronous generator. The variable speed operation for wind generator is attractive because of its characteristic to achieve maximum efficiency at all wind velocities. The gear system incurs around 8-10% energy loss out of the mechanical energy delivered by the wind to the turbine. Gear system is absent in this kind of design. These system doesn't require any constant speed operating generators.

Wind generators are specially designed for wind turbine application. Many designs of generator are available for wind technology. One of the well-known version of wind generators are Induction generators and Doubly-fed Induction generators. DFIG proved to be a very successful technology at constant speed application. The only constraint in the case of DFIG is the need of auxiliary power supply for the _eld winding. As the gen eration level increases, the electromagnet magnetization & magnetic _eld strength need to be increased. The permanent magnet synchronous generator (PMSG) is looked upon as viable option for wind technology which will overcome the major problems of DFIG system. The system is majorly improved due to its capability to work under variable speed shaft. Also, there is no need for _eld excitation supply as permanent magnets are having never lasting magnetic ux. As, the power curve for the system is constantly varying, it is suggested to use PMSG with appropriate power controllers to track the maximum power point of the power curve. Permanent-magnet (PM) generator can be widely used for small size wind turbine, proving high reliability and less maintenance due to simple structure.

The wind systems are, by nature, non-linear power sources that need accurate on-line identification on the optimal operating point. To operate the turbine at optimal power point, it is important to install MPPT controller, which works on the changes in rotor speed according to the variation of wind speed so that the tip speed ratio (TSR) is kept at optimal value. The objective of all MPPT technique is to control the turbine operation at best output point. The parameter controlled to achieve this objective may vary from method to method. Here, we will implement a torque based MPPT controller on a PMSG driven system, coupled with Recti_er-Inverter based DC bus supplying an independent load.



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A Unified Space Vector pulse Width Modulation (USVPWM) for Dual Two -Level Inverter System with Open End Winding AC Machine"

Ms. Pooja Zurale, ME Power System

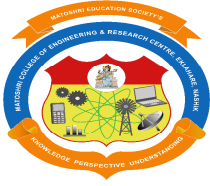
Open winding system has been widely investigated in the field of motor driving and power generation in the last few decades. By employing different combination of converters, the open winding system shows advantages over the conventional star or delta connected structure in many aspects, such as, reducing the DC bus voltage, achieving multilevel modulation effect ,improving the operation performance of motors. However ,a large amount of switch devices have to be used in the open winding system and resulting a complex converter structure, which will not only increase the system expense but also make it complex for the control implementation. In order to avoid the above drawbacks,a semi-controlled open winding system, by integrating a diode bridge and a voltage source converter(VSC), could take the advantages of the less active switch devices, the simpler system configuration and control complexity.

Two isolated DC buses are usually employed in the open winding system to control two converters. Nevertheless , a single DC bus supplied open winding system can take a simpler structure compared with isolated DC bus structure, which is also more convenient for the practical applications .However,a zero sequence current loop will occurring the open winding system when supplied by a common DCbus.The zero sequence currents owing through the stator windings will increase the system conduction losses and decrease the operation efficiency. Meanwhile ,the heavier switch device burden and unexpected DC voltage fluctuation will occur Furthermore, due to that the triple back electromagnetic force(EMF)usually exists in the phase winding s of permanent magnet synchronous generator(PMSG)[the zero sequence current also willing introduce six times frequency torque ripple. As a result, it is necessary to suppress the zero sequence current in the open winding PMSG system supplied by a single DC bus. Permanent magnet synchronous motor(PMSM) drives are increasingly used in electric vehicles, aerospace ,and military applications due to their excellent performance such as high power density, high efficiency and good controllability. However, conventional three phase star-connected winding motor drives have poor fault-tolerant capabilities .In this case, open-end winding ac motor drives fed by dual inverters have been interested in.The dual inverter composed of double two-level inverters can produce space vector locations identical to that of a three-level inverter .So, an increase of DC-link voltage utilization in the open-end winding topology is achieved comparing with the two-level inverter fed star-connected winding topology. Further , additional diodes and capacitors like in the diode clamped and ying capacitor inverters are not required ,and consequently capacitor voltage balancing can be avoided. Additionally, fault tolerance is improved, since the current in each phase of open-end winding motors can be controlled separately. Therefore open-end winding ac motor drives are widely used in electric vehicles high-power electric propulsion aircraft starter-generator, and wind generation systems. A single DC power supply or two isolated ones can be adopted in the dual inverter Two isolated dc power supplies with the equal or unequal voltages are employed to prevent circulation of the zero-sequence current. But, the common-mode voltage in the set topologies could produces haft

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voltage and bearing current which can shorten life time of the motor o simplify t he topology,the dc l inks of the two inverter scan be connected together so that the dual inverter can be fed by a single dc power supply.In the common DC-link dual inverter, there striction that the sum of three-phase currents is equal to zero does not exist. So,the zero-sequence voltage and current in the common DC-link dual inverter have to be suppressed. Otherwise, the zero-sequence current in the motor phases could be high, and does harm to the motor and the semiconductor switches owing to low zero-sequence impedance. That is,to suppress the zero-sequence current is the principal problem for open-end winding drives fed by dual inverter fed by a single DC supply. It is shown in that the zero-sequence voltage can be absorbed with the use of auxiliary switches. The SVPWM strategy employing those switching combinations that do not contribute to the zero-sequence is also introduced introduce the zero-sequence voltage. And also a carrier-based PWM algorithm is used in dual two-level inverters and dual matrix converters to eliminate common-mode voltage. However, due to the voltage drops on the power semiconductor devices and switching dead time, the zero-sequence voltage can not be eliminated although these selected switching combinations are employed. Common mode chokes and dead-time compensation strategies are proposed to suppress the zero- sequence current in.





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Study of Power system using ETAP Software

Hadpe S. S. Faculty, Electrical Engineering Department

Load balancing or load matching is very essential for the healthy transmission of power. It ensures the balance in real time between electricity consumption and generation of electricity. Engineers usually try to balance loads to avoid overloading or under loading of transmission lines. Load calculation is based on volt-ampere (VA) or kilovolt-ampere (kVA) of load to provide an accurate analysis of ampere values which flow in the circuit. The maximum power can be transmitted over a specified system with the balanced system.

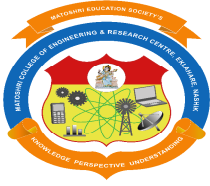
The most common electrical fault in the transmission system is the short circuit. This cause overloading of specific line in the system and thus other substations or feeders experiences blackouts. Protective relaying and relay coordination plays important role in minimizing the faults and also minimizing the damage in the event of faults. Relay coordination is the sequence of tripping of relays which is used in fault analysis.

ETAP is Electrical Transient Analyzer Program which performs accurate numerical calculations within fraction of seconds and provides easy to understand reports as outputs. ETAP is specifically designed for power system simulation in which various analyzes can be performed such as Load flow, Short circuit, Protective device coordination, Transient analysis, Reliability assessment and many more. In this paper, 132KV transmission grid system of Nasik area is simulated using ETAP software for load balancing and fault analysis.

Blackouts in the transmission system are avoided with the use of load trimming or islanding scheme for which load balancing study is required [1]. The analysis, monitoring and optimization of grid the system carried out in ETAP software includes current flowing in every branch, power factor, active and reactive power, etc.. Comparison of results by hand calculation and ETAP simulation of short circuit analysis and relay coordination of overcurrent relay is studied. An interactive power system analysis and studies of short circuits, load flow, transient analysis using ETAP are described.

1. 132KV transmission grid 4-bus system is developed in ETAP 12.6.0 software with overcurrent relays, C.Ts, transformers, power grid, line impedances and lumped loads. Directional relays are used.
2. Each power grid has assigned different short circuit MVA. Buses of 132KV, current transformer parameter (CT ratio 800:1), and load details are entered in the system.
3. Load flow analysis is done to get maximum load currents that can flow throughout the system and to check whether system is balanced or not.
4. A fault case is considered i.e., fault is inserted on line. The sequence of operation of relay and the relay operating time is observed in this case.
5. The results of relay operating time by analytical method are compared with the ETAP output results. scheme for fault analysis needs to be carried out on MSETCL 132KV transmission grid of Nasik region having 4 bus and 3 lines. Various power generation sources (like thermal, hydro, wind, solar, etc.) and different loads are connected.

System used in this paper is 4 bus transmission grid including transmission lines like Eklahare GCR (Grid Control Room), Eklahare OCR (Old Control Room), Sinnar and Sinnar MIDC. All the buses are of 132KV nominal voltage. Out of these 4 lines, there are 2 main generation sources of Eklahare GCR and OCR which are thermal power stations.



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Eklahare GCR is 220/132KV substation. It is a coal based generation and this thermal power station has a capacity of 910MW. Eklahare Grid Control Room (GCR) serves as a central space where a large electrical facility or service can be monitored and controlled. Eklahare OCR is also 220/132KV substation. Sinnar line of nominal voltage 132KV having load of 300A receives the electric power from Eklahare GCR. Sinnar MIDC line of 132KV receives power from OCR and has linked line to Sinnar substation. The positive and zero Sequence impedances and line lengths are provided for all the lines. This 3-bus system is simulated using ETAP software to solve the problem of overloading on occurrence of faults, tripping of lines.

DOCTORS vs ENGINEERS

SCENE 1

(PUNE- MUMBAI):

7 engineers take only 1 Ticket and 7 doctors buy all 7 tickets..
Doctors are desperately waiting for TC to come.....

When TC arrives,

All 7 Engineers get in one toilet so when TC knocks,
one hand come out with the ticket and the TC goes Away....

NOW on return Journey

All of them don't get a direct Train to PUNE.

So they all decide to take a Passenger till Lonavala,
from there they can easily get a LOCAL to PUNE

SCENE 2

(MUMBAI - LONAVALA):

Doctors decided, "this time we will prove that we too are equal"....
All 7 Doctors take 1 Ticket Engineers don't buy any ticket at all!!!!!!..

TC arrives....

ALL DOCTORS IN ONE TOILET..ALL ENGINEERS IN THE OPPOSITE ONE..
One engineer gets out and knocks the door of Doctors toilet,
One hand comes with the tickets, he takes the ticket and comes in Engg. Bathroom...

TC DRIVES out ALL the doctors from the toilet and they are heavily fined

SCENE 3

(LONAVALA):

SO now both the group r on LONAVALA station.
Doctors planning their move for last chance, they board the local to Pune.

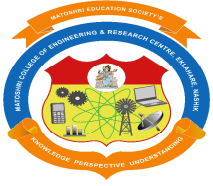
This time doctors decide that they will play the same (1 ticket) trick.

ALL Doctors take 1 tickets...
Engineers BUY all 7 tickets this time...

SO TC Comes..

All Engineers showed their tickets....
Doctors are still searching for toilet in the LOCAL train.....

Conclusion: Technically intelligent people are geniuses, don't mess with Engineers....



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Increasing the Accessibility of Machine Learning at the Edge

Reference- www.electronicforum.com

"Edge intelligence" is becoming more accessible—even to those designers without formal data science training—as new hardware becomes available.

In recent years, connected devices and the Internet of Things (IoT) have become omnipresent in our everyday lives, be it in our homes and cars or at our workplace. Many of these small devices are connected to a cloud service—nearly everyone with a Smartphone or laptop uses cloud-based services today, whether actively or through an automated backup service, for example.

However, a new paradigm known as "edge intelligence" is quickly gaining traction in technology's fast-changing landscape. This article introduces cloud-based intelligence, edge intelligence, and possible use-cases for professional users to make machine learning accessible for all.

Key Machine Learning Terms

Cloud Computing

Cloud computing, simply put, is the availability of remote computational resources whenever a client needs them.

For public cloud services, the cloud service provider is responsible for managing the hardware and ensuring that the service's availability is up to a certain standard and customer expectations. The customers of cloud services pay for what they use, and the employment of such services is generally only viable for large-scale operations.

Edge Computing

On the other hand, edge computing happens somewhere between the cloud and the client's network.

While the definition of where exactly edge nodes sit may vary from application to application, they are generally close to the local network. These computational nodes provide services such as filtering and buffering data, and they help increase privacy, provide increased reliability, and reduce cloud-service costs and latency.

Recently, it's become more common for AI and machine learning to complement edge-computing nodes and help decide what data is relevant and should be uploaded to the cloud for deeper analysis.

Machine Learning (ML)

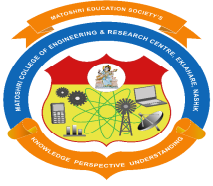
Machine learning (ML) is a broad scientific field, but in recent times, neural networks (often abbreviated to NN) have gained the most attention when discussing machine learning algorithms.

Multiclass or complex ML applications such as object tracking and surveillance, automatic speech recognition, and multi-face detection typically require NNs. Many scientists have worked hard to improve and optimize NN algorithms in the last decade to allow them to run on devices with limited computational resources, which has helped accelerate the edge-computing paradigm's popularity and practicability.

One such algorithm is MobileNet, which is an image classification algorithm developed by Google. This project demonstrates that highly accurate neural networks can indeed run on devices with significantly restricted computational power.

Machine Learning for More Than Just Experts

Until recently, machine learning was primarily meant for data-science experts with a deep understanding of ML and deep learning applications. Typically, the development tools and software suites were immature and challenging to use.



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Machine learning and edge computing are expanding rapidly, and the interest in these fields steadily grows every year. According to current research, 98% of edge devices will use machine learning by 2025. This percentage translates to about 18-25 billion devices that the researchers expect to have machine learning capabilities.

In general, machine learning at the edge opens doors for a broad spectrum of applications ranging from computer vision, speech analysis, and video processing to sequence analysis.

Some concrete examples for possible applications are intelligent door locks combined with a camera. These devices could automatically detect a person wanting access to a room and allow the person entry when appropriate.

Modern Hardware Solutions Enable ML Processing on the Edge

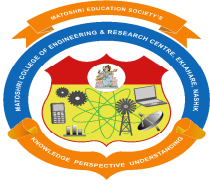
Due to the previously discussed optimizations and performance improvements of neural network algorithms, many ML applications can now run on embedded devices powered by crossover MCUs such as the i.MX RT1170. With its two processing cores (a 1GHz Arm Cortex M7 and a 400 MHz Arm Cortex-M4 core), developers can choose to run compatible NN implementations with real-time constraints in mind.

Due to its dual-core design, the i.MX RT1170 also allows the execution of multiple ML models in parallel. The additional built-in crypto engines, advanced security features, and graphics and multimedia capabilities make the i.MX RT1170 suitable for a wide range of applications. Some examples include driver distraction detection, smart light switches, intelligent locks, fleet management, and many more.

The i.MX 8M Plus is a family of applications processors that focuses on ML, computer vision, advanced multimedia applications, and industrial automation with high reliability. These devices were designed with the needs of smart devices and Industry 4.0 applications in mind and come equipped with a dedicated NPU (neural processing unit) operating at up to 2.3 TOPS and up to four Arm Cortex A53 processor cores.

Built-in image signal processors allow developers to utilize either two HD camera sensors or a single 4K camera. These features make the i.MX 8M Plus family of devices viable for applications such as facial recognition, object detection, and other ML tasks. Besides that, devices of the i.MX 8M Plus family come with advanced 2D and 3D graphics acceleration capabilities, multimedia features such as video encode and decode support including H.265), and 8 PDM microphone inputs.

An additional low-power 800 MHz Arm Cortex M7 core complements the package. This dedicated core serves real-time industrial applications that require robust networking features such as CAN FD support and Gigabit Ethernet communication with TSN capabilities.



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Communication Protocols: Reviewing the Options for Encoder Applications

Reference- www.electronicsforum.com

This article discusses the use of an encoder to ensure accurate ongoing tracking of a motor's rotor shaft and the key factors that will help in the selection of the encoder based on different parameters.

Increasing use of motors in robotics, industrial drives, factory automation systems, renewable energy generation sites, and so on, combined with a growing need for more power-efficient operation, has caused a major ramp-up in rotary encoder usage in recent years. In Insight Partners' recent report on this subject, the analyst firm forecast that the overall encoder market will experience a 10.2% compound annual growth rate (CAGR) in its worldwide revenue figures between now and 2027. Consequently, it is expected that this market will be worth \$3.45 billion a year by the end of that period.

To maximize operational efficiency levels of a motor, accurate ongoing tracking of its rotor shaft is needed. This will allow constant data to be acquired on the rotor's position, plus the speed and direction of its movement. Such functions can be achieved by the inclusion of some form of an encoder in the system design. However, before deciding on the nature of the encoder that will be specified, you need to understand the key factors that will influence this decision given a set of application or logistical requirements.

Absolute or Incremental?

There are several possible options available when choosing an encoder. An incremental type will help with determining the position relative to a reference point, while an absolute encoder assigns a unique code to each potential rotor position. Although incremental encoders are cheaper and simple to implement, absolute encoders have clear operational advantages associated with them. The most notable advantage of using absolute encoders is the fact that they have an immediate response (as they simply need to identify the specific code). Through their use, the rotor position can be determined as soon as the system is activated. This is particularly advantageous in safety-critical application scenarios.

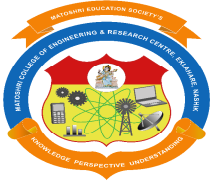
Which Encoder Type Should Be Used?

There are also several different ways via which the encoding mechanism may be implemented. Often, optical sensing is employed. However, this has certain drawbacks, especially in heavy-duty industrial environments - as the presence of dirt, grease, or oil can obscure parts of the encoder disk, thereby making it difficult for the accompanying photo-sensor to obtain correct results. Ongoing exposure to shocks or vibrations can also lead to the disk becoming damaged and needing to be replaced. Exact alignment is also required, which can be an iterative and time-consuming process.

Although magnetic encoders get rid of the line-of-sight issue that impairs optical encoders, these have their own drawbacks. They are relatively power-hungry and are not capable of supporting high resolutions. It is for these reasons that capacitive absolute encoders, like those featured in CUI Devices' AMT Series, are now seeing a great deal of uptake. These capacitive encoders are insusceptible to the presence of dust, dirt, and grease. Alongside this, they have strong resilience to vibrations and extreme temperatures. They offer continued reliability, with a long and trouble-free working lifespan - as, unlike optical encoders, they are less prone to mechanical wear and tear. At the same time, they can provide far higher degrees of accuracy than their magnetic equivalents

Integrating an Encoder

Having decided on the encoder mechanism, the next element that needs to be addressed is interfacing the encoder with the host system. There are a wide variety of interface protocols that can be employed. It



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is therefore important to understand the distinctions between them in order to select the most appropriate option. Serial interfaces are commonly used for communication in industrial systems. RS-485, serial peripheral interface (SPI), and synchronous serial interface (SSI) are among the most prominent of these protocols. SPI provides a bi-directional interface capable of supporting full-duplex operation. As there are many host microcontroller units (MCUs) that have an SPI port directly incorporated, it is a convenient means via which to implement an encoder system - taking up minimal time and effort. Elevated data rates can be supported, and it is easy to adjust this rate as well.

The use of SPI will be optimal when the interconnect distances involved are relatively short (ideally under one meter). Longer distances can be accommodated, but it will be necessary to reduce the data rate to maintain acceptable noise immunity. CUI Devices' AMT22 Series is one such SPI encoder, with a maximum clock speed of 2 MHz. When requested, the encoder can provide extremely quick position feedback, within 1500 ns, to the host microcontroller. Extended commands can also be used over the SPI connection to set the zero point or reset the encoder.

Better suited to longer interconnect distances than SPI, or for use in situations where there is substantial electrical noise present, RS-485 is another option. As this is an asynchronous interface protocol, it requires no clock signal. Its differential signaling enables common-mode noise rejection and the strong noise immunity offered means that it can be deployed in extremely challenging environments where electromagnetic interference (EMI) is prevalent.

Unlike SPI, it is not necessary to curb data rate when the distance is extended. With a dedicated RS-485 transceiver the communication speed can reach 10 Mbps or higher, dependent on the distance the data needs to travel across a twisted pair cable. The cable is then terminated at each end with a resistance equal to the characteristic impedance.

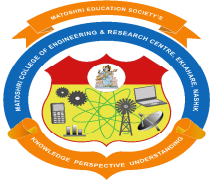
Another major benefit of RS-485 is that several encoders can all be connected to one bus. For implementations based on RS-485 technology, the AMT21 encoder provides a solution. Its default protocol of eight data bits, no parity, and one stop bit works by having the two lower bits define the encoder command with the other 6 bits used as an encoder address. This means that up to 64 encoders can share the same bus — providing advantages in complex, large-scale implementations. AMT21 encoders can also respond to positioning requests from the host within a 3 μ s period.

Data transported via SSI is synchronized by the transmitter and receiver both referencing a common clock signal. This simplex one-way communication protocol relies on differential signaling and presents a very cost-effective interface solution. It can handle similar interconnect lengths to SPI and has comparable noise performance characteristics too.

CUI Devices' AMT23 Series offers a solution in situations where SSI is the chosen interface. CUI Devices' variation of a standard SSI protocol comes with a three-wire SSI interface incorporating a chip-select connection, which streamlines installation and simplifies the interface between host and encoders. The chip-select feature enables the host to activate specific individual encoders on the bus, while the encoder responds by simply putting position data on the bus.

Conclusion

Through the expansive portfolio of capacitive absolute encoders supplied by CUI Devices, and the array of interface technologies that these units support, engineers will be able to find a solution that matches their particular application requirements. In situations where there may be lengthy connection distances involved or noise levels need to be mitigated, it will be advisable for an RS-485 interface to be utilized.



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Intro to Fiber-Optic Communication Systems

Reference- www.electronicsforum.com

What Is an Optical Communication System?

For decades, electronic signals have been sent effectively via normal 'hard-wired' connections or by the use of different kinds of radio links which had their own downfalls. On the contrary, optic fiber links, whether utilized for video or audio links over long or short ranges, offer some unique advantages as compared to the standard wired cables. This article delves to discuss the optical transmitters and receiver circuits for fiber-optic communication systems.

Presently, the growth in information technology has had increased use of the current telecommunication systems. Often, optical fiber communication plays a significant role in the development of telecommunication systems with high quality and speed. Nowadays, optical fiber applications majorly involve telecommunication systems with an inclusion of internet and local area networks (LAN) to achieve high signaling rates.

How Fiber Optics Work

In optical fiber technology, an optical fiber link is utilized to transfer analog or digital data in light frequency form via a cable with a highly reflective central core. The role of the highly reflective central core is to act as a light guide for the transfer of light through it through continuous reflections across its characteristic reflective walls. As is illustrated in the block diagram below, the optical fiber communication module mainly comprises a transmitter (Tx) circuit and a receiver (Rx) module.

As is common, a transceiver- a module that includes a transmitter and receiver- is employed in most systems. The input to the transmitter comprises an electrical signal which converts into an optical signal from either a light-emitting diode (LED) or laser diode. As required, the light signal from the transmitter is linked to the fiber cable with the use of a connector and broadcasted via the cable. Subsequently, the light signal from the fiber terminal can be linked to a receiver, anywhere a detector converts the light to an electrical signal, after which it is suitably conditioned for use by the receiving equipment.

Pros and Cons of Fiber Optics

A most important aspect of the fiber optic circuit links is the perfect immunity to the electrical interference and stray picks ups. While the problem of electrical interferences and stray pick-ups may be reduced by designing the standard cable links, it may be increasingly difficult to entirely eliminate the issue. In contrast, the non-electrical attributes of the optical fiber cables aids in making the electrical interference inconsequential with an exception of the possible disturbance at the receiver terminal, which may be eradicated via effective shielding of the receiver circuit.

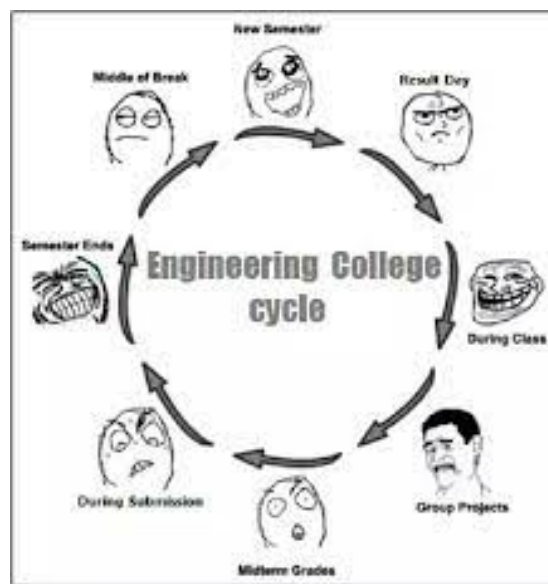
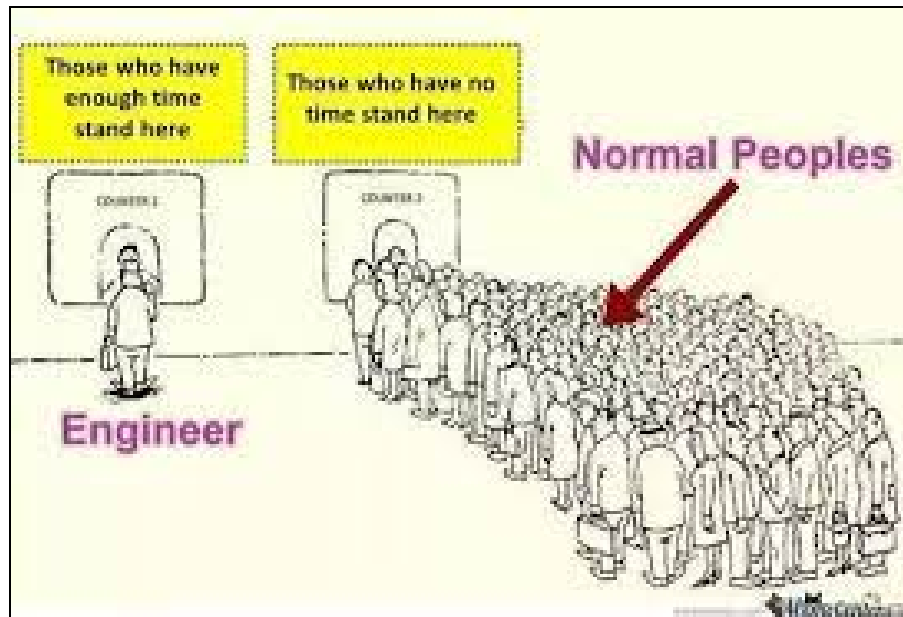
Systems that incorporate optic fiber cables working together have close to no complication or issues associated with cross-talks. This is so given the encapsulation of the fiber optic cables preventing any light leakage. As such, links done by fiber optic guarantee a reasonably safe and reliable transfer of data. Besides, through suitable transmitting and receiving circuits, it is increasingly suitable for the fiber optic links to have the capacity of handling substantial bandwidth ranges, especially due to the improved electrical isolation in the entire like making sure no complications with earth loops develop. Notably, optic cables are typically slim and lightweight with immunity to climatic conditions and various other chemical substances. As a consequence, they are frequently used with ease in inhospitable environments where electrical cables, particularly coaxial cables would otherwise be very ineffective.

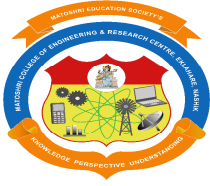
Like any system, although fiber optic circuits boast various advantages, it has its shortcomings. For instance, a shortcoming that is quite apparent is the impossibility of having the electrical signals

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transferred directly into the fiber optic cable. The problems and cost associated with the crucial encoder and decoder circuits are contradictory. Besides, bending optical fibers is often undesirable as twisting them with a sharp curve exposes them to physical damage making them functionally useless since propagation of light signals will be hindered resulting in drastic losses.

www.google.com





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Design of Piezoelectric Energy Harvesting and Storage Devices

Reference- www.electronicforum.com

Piezoelectric Power harvesting is a very important concept in power electronics. Power harvesting may be defined as a process of acquiring energy surrounding a system and converting it into electrical energy for usage. Piezoelectric energy harvesting is one of the most reliable and energy efficient method. The crystalline structure of piezoelectric materials provides the ability to transform mechanical strain energy into electrical energy. It also has the ability of converting an electrical potential into mechanical strain. The power generated by a piezo ceramic is AC wave and not directly used in battery charging, hence we use Rectifier circuit to convert AC to DC, boost converter to step up the value and a lithium ion battery charger circuit to finally charge the lithium ion / lithium polymer battery.

Introduction

Piezo electricity is the amount of charge accumulated due to mechanical strain applied on it. The recent advancements in micro electro-mechanical systems technology have created a demand for portable electronics to grow rapidly. It also becomes more necessary for the portable devices to carry power supply of their own along with them. Conventional battery is the best choice as power supply for these devices in most of the cases. The power generation from mechanical vibration uses vibration surrounding the power harvesting device which is used as an energy source and converts it into useful electrical energy in order to power other devices. The idea of capturing the energy surrounding an electronic system and converting it into usable electrical energy that could extend the lifetime of the power supply or provide an endless supply of energy has captivated many researchers and brought much attention to power harvesting. One method of obtaining the energy surrounding a system is to use piezoelectric materials. Piezoelectric materials have the unique ability to interchange electrical and mechanical energy. This property allows them to be uses to absorb the mechanical energy around a system, usually ambient vibration, and transform it into electrical energy that can be used to power other devices. In this paper, it proposes efficient method of storing energy by the use of piezo ceramic. It is very reliable to use piezo ceramic for generating electrical energy which can be used for powering any portable devices. The basic concept of piezo ceramic is that the mechanical strain applied on to the ceramic such as bimorph or unimorph piezo converts it into electrical energy. In the present day scenerio, wherein there is great demand for energy, this idea of piezoelectric concept works well.

Related Work

Piezoelectric materials when used as a means of gathering energy from the surroundings, in most cases it is a necessity that a means of storing the energy generated be used. Without accumulating a significant amount of energy, the power harvesting system will not be a feasible power source for most electronics. Battery has been the power source of most electric-driven devices. However, the limited lifetime and physical dimension of batteries have rendered traditional batteries unacceptable for some power critical or maintenance free real-time embedded applications such as the wireless sensor, orthopedic implants, etc. The piezoelectric approach to power harvesting has several advantages like: their small size and the ability to be fabricated in custom shapes. Previous technologies using piezoelectric power generation

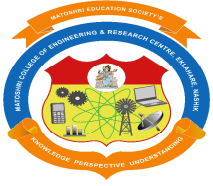
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have focused on generic power generation (i.e. for any low-power electrical device). These studies have shown that sufficient power can be generated from a piezoelectric device in an ordinary shoe to power a telemetry identification tag over several meters during walking. This work on Piezoelectricity has led to the design of compact, maintenance free and cost effective system wherein the day-to-day activities of human such as walking, jogging, running etc can be used in generation of electrical energy.

Conclusion & Future Scope

Piezoelectric energy harvesting is a very interesting concept, in present day life, where there is a great demand for energy, it is best suitable and also very efficient way of energy harvesting. Piezo ceramic converts the mechanical stress applied on it into electrical energy. This electrical energy is further stored in a device like lithium polymer batteries so that it can be used in portable devices such as mobile phones or other hand held electrical devices. It is very reliable as it uses the movement of man such as walking, jogging etc, to produce energy. The Rectifier, DC –DC converter and battery charging circuit used in the project contains minimum number of components and hence it is very compact, low cost and the future changes can be made without much difficulty in the hardware. The inclusion of further components in the circuit can be made easily.





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Concept of Big data and its basic introduction

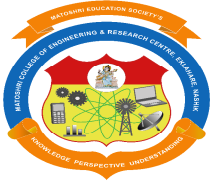
- Yuvraj Jadhav (B.E.I.T)

Today with social media and internet availability, large amount of data is generated. Managing or organizing such vast data is the need of the day. Big data concept mainly deals with such a vast amount of data and its organization. It basically refers to the massive amount of digital information companies and governments collect about us and our surroundings. Going beyond of basic online source, these data is not only generated by traditional information exchange and software use via desktop computers, mobile phones and so on, but also from the myriads of sensors of various types embedded in various environments, whether in city streets (cameras, microphones) or jet engines (temperature sensors), and the soon- digital life rate Internet of Things, where virtually every electrical device will connect to the Internet and produce data. Every day, we create 2.5 quintillion bytes of data—so much that 90% of the data in the world today has been created in the last two years alone (as of 2011 [1]). Not only the quantity of data is large but even the types of data is also varied and is of different types. The issues of storing, computing, security and privacy, and analytics are all magnified by the velocity, volume, and variety of big data, such as large-scale cloud infrastructures, diversity of data sources and formats, streaming nature of data acquisition and high volume inter-cloud migration.

With the vast amount of data it is applicable in various industries and has applications. Big data presents a tremendous opportunity for enterprises across industries. By tapping into new volumes and varieties of data, scientists, executives, product managers, marketers, and a range of others can start making more informed plans and decisions, discover new opportunities for optimization, and deliver breakthrough innovations. Without the right security and encryption solution in place, however, big data can mean big problems. Securing big data comes with its own unique challenges beyond being a high-value target. Its not that big data security is fundamentally different from traditional data security. Big data security challenges arise because of incremental differences, not fundamental ones. The differences between big data environments and traditional data environments include:

- The data collected, aggregated, and analyzed for big data analysis: There are numerous ways and strategies for such aggregation and analysis. There is a huge scope in these streams for learning and even applications.
- The infrastructure used to store and house big data: A lot research is in progress for the required infrastructure for the proposed big data structure. A concept of house big data is introduced to store data.
- The technologies applied to analyze structured and unstructured big data: Various technologies are introduced to store and work on the concept of big data.

Considering the amount of data and its application, a lot research is still in progress.



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Applying Brain fingerprinting concept in forensics. Dani Akshay (T.E I.T)

Brain Fingerprinting was developed and patented in 1995 by Dr. Lawrence A. Farwell, chairman of the Brain Wave Institute in Fairfield, Iowa, and former Harvard University research associate. Brain fingerprinting is based on the theory that throughout any action, the brain plans, records, and executes all of the actions. Such details, all concealed within the brain, can now be revealed through brain fingerprinting. This technique measures how brain waves respond to specific words or pictures flashed across a screen. Pictures, both relevant and irrelevant to the actions, are shown. The relevant images should trigger memories of subject.

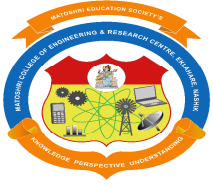
Basic fundamental of this technique is whether an individual recognizes specific information related to an event or activity by measuring electrical brain wave responses to words, phrases or pictures presented on computer screen. The technique can be applied only in situations where investigators have a sufficient amount of specific information about an event or activity that would be known only to the perpetrator and Investigator. In this respect, Brain Fingerprinting is considered a type of Guilty Knowledge Test

The entire Brain Fingerprinting System is under computer control, including presentation of the stimuli and recording of electrical brain activity, as well as a mathematical data analysis algorithm that compares the responses to the three types of stimuli and produces a determination of "information present" ("guilty") or "information absent" ("innocent"), and a statistical confidence level for this determination. At no time during the testing and data analysis do any biases and interpretations of a system expert affect the stimulus presentation or brain responses.

The devices used in brain fingerprinting Equipment required:

- Personal computer
- A data acquisition board
- A graphics card for driving two monitors from one PC
- A four-channel EEG amplifier system.
- Software developed for data acquisition and analysis.

Compared to other forensic tools the proposed tool can give better results. But, it is costly to use as compared to others.



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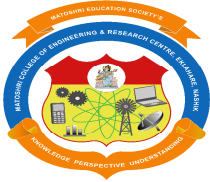
Control data spams on social sites using natural language processing

Kasar Pooja (T.E.I.T)

Social media is becoming a daily life routine of all the human beings. Any of the important information can be taken from the social sites. More than 170 million people are using online media to be connected to their friends, co-worker and family members. There are so many topics, subjects, events, jokes, news discussed by people on it. To know which topic is hot on the social media and why, there is need to invent a system. As few events get more attention whether some get less. Detecting trending topics is perfect to summarize information getting from social media. To extract what topic is becoming hot on online media is one of the challenges. Everyday anyone can post and share anything of their own interest. One particular most viral trending topic to be found is a need. As we considering social media so social services are opportunity for spamming which greatly affect on value of real time search. Therefore the next task is to control spamming from social networking sites. For completing these challenges different concepts of data mining will be used. For now whatever work has been done is narrated below like spam control using natural language processing for preprocessing and clustering. One account has been created for making it real.

The first step is preprocessing which is important for mining the data or filtering the data. The work of preprocessing has been done. Then the spam control has been done. Spam control is the part of feature extraction. Here used the bisecting K-means clustering algorithm, because clustering is an important step for quality results. So nothing but natural language processing (NLP) technique has been used for preprocessing, clustering etc. Feature extraction is used for reduction of dimensionality. Before classification there is need of reduction of feature space. Now spam control is also nothing but a feature reduction task. Therefore, slang word reduction is done for the spam control. For spam control, dictionary of slang words is created. So, whenever user use any slang word in the post or comment that word matches with the words available in the dictionary and it replaces with the stars (****).

With spam control the social media sites usage can be increased safely in the recent times. It is an important informative tool if we use it wisely. The domain can further gain popularity if we control the limitations and try to overcome the spams. The main aspects of the proposed work are to detect the current topics of real world and to control the spamming created by spammer. Preprocessing process is done. One account is created for showing results. Also feature extraction is the part of spam control has done. Then, one part of event detection i.e. classify events field wise is done. So the next work is to implement current event detection i.e. second part of event detection in the same created account.



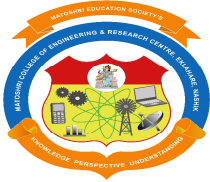
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An introduction to semantic web search engine- Shaikh Shehzad (T.E.I.T)

The web search engine has become a part of everyone's learning this days. The World Wide Web (WWW) allows people to share information or data from the large database repositories globally. We need to search the information with specialized tools known generically as search engines. There are many search engines available today, where retrieving meaningful information is difficult. However to overcome this problem of retrieving meaningful information intelligently in common search engines, semantic web technologies are playing a major role. Proposed work presents a different implementation of semantic search engine and the role of semantic relatedness to provide relevant results. The concept of Semantic Relatedness is connected with Wordnet which is a lexical database of words. We also made use of TF-IDF algorithm to calculate word frequency in each and every webpage and Keyword Extraction in order to extract only useful keywords from a huge set of words. These algorithms are used to retrieve much optimized and useful results to the user.

Most of the traditional search engines search for keywords to answer queries from users. The main focus of these search engines is solving queries with close to precise results in small period of time using much advanced algorithms. However, it shows that such search engines are incompetent in answering queries intelligently using traditional approach. This is where semantic web search engine comes into picture. The Semantic Web will support more efficient discovery, automation, integration and reuse of data and provide support for interoperability problem which cannot be resolved with current web technologies. In short it will intelligently understand the user query and search for those results that match not only the keyword but also the meaning of that query. In this paper, we will make modification over the existing search engine by adding an additional concept of keyword extraction and semantic relatedness calculation. Semantic relatedness here, is a metric which calculates the relation between words. This metric is computed with the help of Wordnet. Another metric used in the current approach is TF-IDF (Term Frequency-Inverse Document Frequency). It is used to calculate the relevancy of each word and relevance of each document.

This Semantic Web Search Engine has improved the search quality to great extent. As the traditional search engine only checks for the frequency of the word; this Search Engine looks for the relation that is the relatedness of the words in a web page.



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Importance of ICT in teaching and learning systems Deore hemangi (I.T)

Language is the mirror of human life which delineates the life of human. Language speaks man's personality. It is the cosmic medium like imparting the common information society. English and ICT have become essential tools for a number of non-datum and emotions of everyday life. ICT means Information and Communication Technology. According to Kent, "ICT in education point of view refers to Information and Communication Technology such as computers, communications facilities and features that variously support teaching learning and a range of activities in education. Because of its interactive and dynamic nature ICT has the stamina to meet the needs of the individual student by providing opportunities to direct their learning and to pursue information. With the usage of ICT students can learn any subject especially English with ease. In the context of the global exchange the role of ICT has become inevitable in the 21st century. The use of ICT has become essential in every day classroom teaching and learning. It's use gives a chance to teachers as well as students to increase the quality of education and meet the requirements set by the coeval knowledge society. ICT has become essential tool for educational change and reform. English language has become a global language because of its numerous functions and preferences over several other languages over the globe. English has become the window to the world. English is not only the mother tongue of Britain but also to so many countries like Canada, USA, Newzealand etc. It is also used as second language in many countries like Nigeria, Ghana etc. English has become a medium for business and interactional purposes among other functions. English is playing a major role in every field such as medicine, engineering, education, art and law, music etc. As the world is changing, there must be changes in language learning. But contemporaneous collide of globalization, the expanse of English and technological development have transformed our learning and teaching English as a Lingua franca in an unprecedented way. In every aspect of human life, Science, Information, Technology are playing a vital role. Even in the field of education the technological developments have started a new page. Traditional methods of teaching are not showing great impact on the learners. Technology has become a tool for making the learners innovative and also became a source for motivating the learners towards learning. To compete with this native speakers of English.

Various ICT tools like mobile apps, internet, online portals and services are the tools which can enhance the learning by firstly creating interest in the study and learning. ICT's are intrinsic tools in many educational institutions. The use of ICT increases the scope of teaching. It provides quality learning materials and creating autonomy of learning. Along with academic excellence students must have English communicative skills for their prosperous future. Curriculums must be made easy by including technological aids. Learners can share their work which can promote cultural diversity, have positive motivational effects and raise self-esteem.

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Domestic Refrigerator: The Biggest Contribution of a Typical Domestic Refrigerator To Humanity Will Ever Rule The World. *L. G. Kamde*

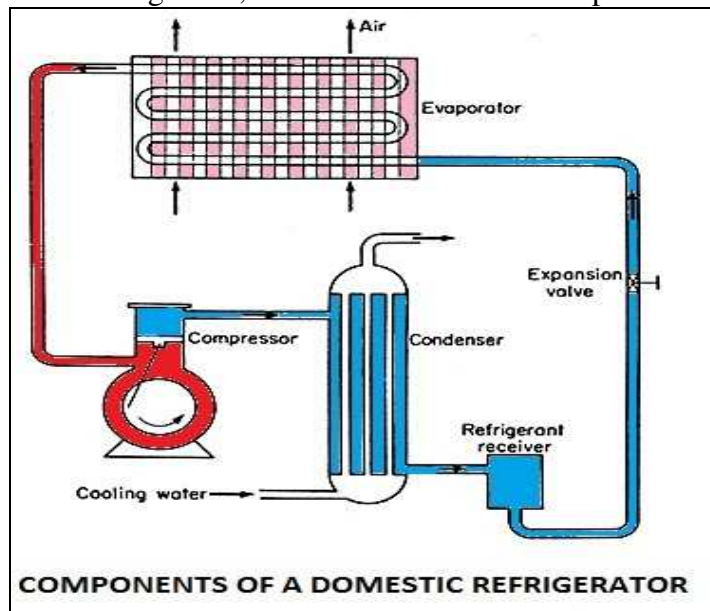
Domestic Refrigerators, once considered a luxury, are now a necessity of daily life. They have usage in homes, hotels, office, laboratories, hospitals, shops restaurants, etc. They are manufactured in several sizes and many brands are available. The different models are rated on the basis of gross volume such as 100 litres, 165 litres, 200 litres, 250 litres and so on.

What a domestic refrigerator is used for

For food to be fresh, the immediate atmosphere needs a low temperature to decrease reproductive rate of harmful bacteria. A refrigerator transfers heat from inside to outside, which is why touching the back side of the fridge where the metal pipes makes it feel hot – you’ll see how it works in a moment.

Description of Domestic Refrigerator

The construction of household refrigerator, with location of main components.

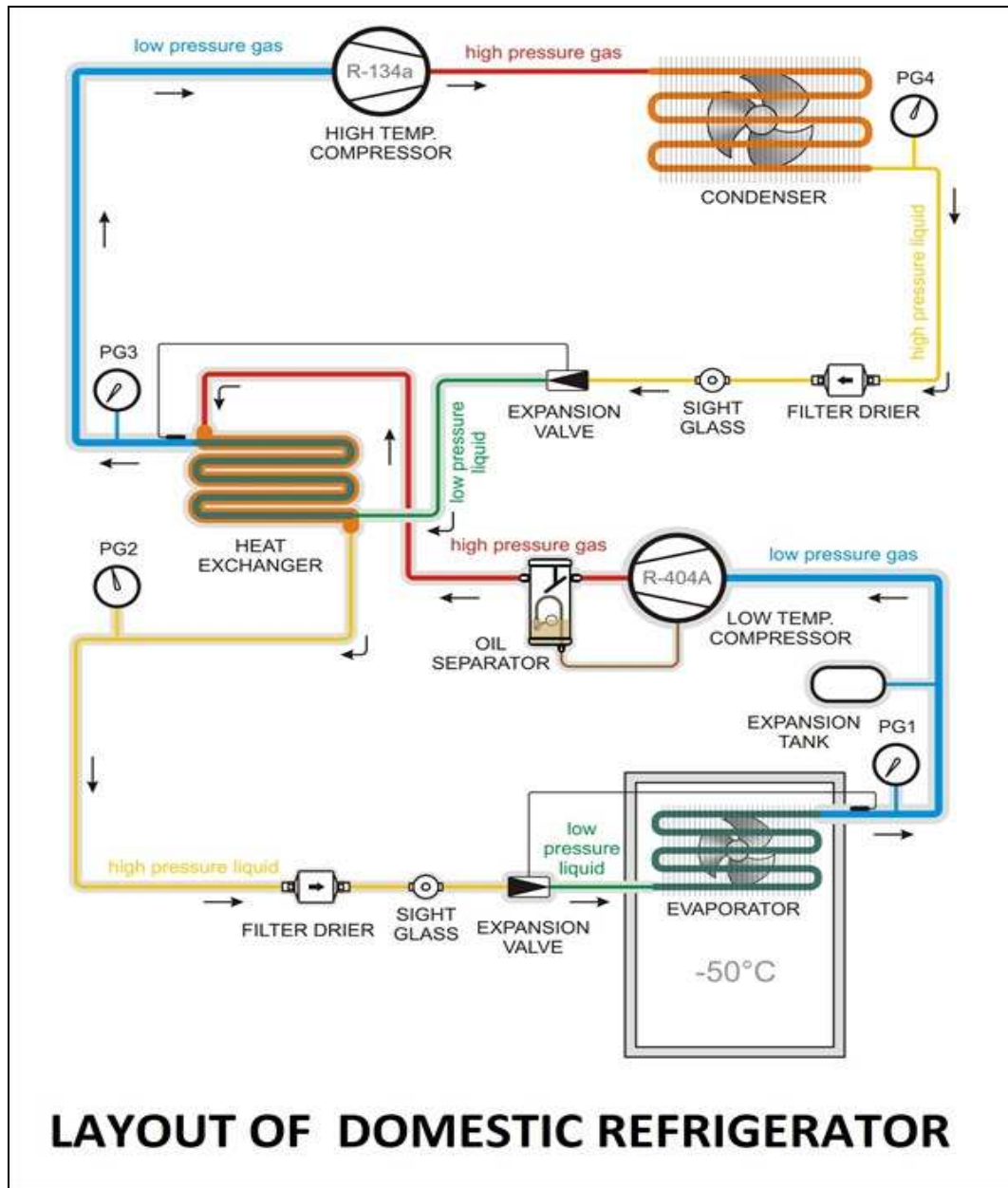


- 1. Evaporator:** The evaporator is located in a coil form on the freezer box. The liquid refrigerant is evaporated in the evaporator by absorbing heat from the contents of the domestic refrigerator in the cabinet. The evaporator consists of copper metal rubbing surrounding the freezing and cooling compartments.
- 2. Condenser:** The condenser is located as zigzag tubes behind the refrigerator on a mesh. In the condenser, the heat from the refrigerant at a higher temperature is rejected to the atmospheric air.
- 3. Compressor:** The compressor is located at the base at the rear end. It compresses the refrigerant vapour to a high pressure. Reciprocating compressor is used for low capacity domestic refrigerator.
- 4. Expansion Valve or Throttling Valve:** An expansion valve is used to reduce the temperature and pressure of the liquid refrigerant, before it passes to the evaporator. The expansion capillary is located inside the refrigerator body near the wall. The capillary tube is small diameter tube used as an expansion device.

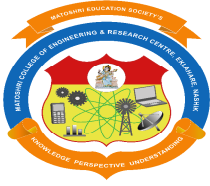
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5. Refrigerator cabinet: The refrigerator cabinet is thermally insulated to minimize heat flow from the atmosphere into the refrigerator. The insulation is glass fiber and the external body is of stainless steel.

Working Principle of Domestic Refrigerator



The refrigerator works on the vapour compression refrigeration cycle. The refrigerant vapour is first compressed in the compressor. The compressor is a special one known as the hermetic compressor. In this unit, the compressor is sealed casing along with an electrical motor to run. This sealing prevents leakage of refrigerant and lubrication oil. The pressure and temperature of the refrigerant increases after



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compression and is subsequently condensed in a condenser. In the condenser, the refrigerant rejects heat to a coolant and cools down and finally gets condensed.

The condensate is then allowed to pass through capillary to reduce temperature and pressure by expansion of refrigerant. The refrigerant is filtered before entering the capillary tube. The pressure of the refrigerant, when it leaves the capillary, is maintained above atmospheric and temperature corresponds to saturation temperature so that the refrigerant can absorb heat in the evaporator. The refrigerant enters the evaporator and is heated by the heat absorbed from the body or space thereby producing the refrigeration effect. The vapour refrigerant enters the compressor again and the cycle is completed.

When power to the compressor is switched on, a humming sound is heard and the refrigerator is functional. The refrigerant flows through its circuit and ice is produced in the freezer. Frost, i.e., moisture from ambient air, gets deposited on the evaporator coil. Defrosting removes this frost. The water from defrosting is collected in a tray to be removed manually. Articles to be refrigerated are placed on shelves. Fruits and vegetables, which contain moisture, are stored at the base. The temperature here is around 8°C. Thus there are temperature gradients in the refrigerator, negative temperature in the freezer and positive temperature at the base.

What is the refrigerant, and how does each kind of refrigerant differ?

Coolant is the fluid or gas used in a refrigeration coil in a domestic refrigerator. If your unit includes R404, R134a or R600a refrigerant in a professional kitchen, it does not really make any difference.

In general, the product's total output and capability is a much more significant purchasing decision. However, some kinds of coolant are more ecological than others. R290 is generally regarded as environmentally friendly, while other refrigerant forms also produce greenhouse gases.

How does domestic and commercial refrigerators differ?

Commercial refrigerator is designed to be used much more frequently. Only a dozen times a day can a house refrigerator be opened while, over a few hours, a commercial refrigerator can be constantly opened. Commercial refrigerators are equipped with powerful compressors, construction which is much robust and are often supported by fans. These commercial refrigerators makes unwanted noisier sound which is a disturbing factor.

Link of an article :

<https://blogmech.com/domestic-refrigerator-layout-of-a-typical-domestic-refrigerator/>

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How Does an Air Conditioner (AC) Work?

Mr. Sanket Ghuge, BE Mechanical

AC operating principle of the air conditioner

An air conditioner in a room or a car works by absorbing hot air from a particular room, processing it into itself with the help of a refrigerant and a series of coils, and then releasing cool air into the same room where the hot air was originally collected.

This processing is mainly carried out via five components:

- Evaporator
- Compressor
- Condenser
- Expansion valve
- Refrigerants

Imagine being outside in the sweltering heat of a particularly hot summer day, doing godforsaken errands that can no longer be postponed. The heat is so unbearable that it feels like the hottest day on earth since the dawn of civilization. But one thing keeps you on your toes: the knowledge that you will be in your air-conditioned house in an hour.

The time has finally come: you open the door and enter your house. A gust of cooled air envelops every cell of your body and you immediately feel better.

Parts of an AC

There are two main types of air conditioning systems: window systems and split systems, which are further divided into mini-split and central systems. In everyday language, these are commonly referred to as window ACs or split ACs.

Regardless of the type of installation, all air conditioners consist of four main components, which are listed below:



(Photo Credit : ScienceABC)

Evaporator

An evaporator is basically a heat exchanger coil that is responsible for collecting heat from the interior of a room by means of a refrigerating gas. This component is called an evaporator and is where the liquid refrigerant absorbs heat and evaporates into a gas.

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The indoor unit of a split air conditioner contains the evaporator coil (Photo Credit : Shutterstock)

The most common refrigerant gases used in air conditioning systems include hydrofluorocarbons or HFCs such as R-410A, chlorofluorocarbons or CFCs such as R-22 and hydrocarbons such as R-290. This gas actually absorbs heat from the room and passes to the next component for further processing, which...

Compressor

As the name implies, the gaseous refrigerant is compressed here. It is located in the outdoor unit, i.e. in the part that is installed outside the house.

Condenser

The condenser absorbs the evaporated refrigerant from the compressor, converts it back into a liquid and expels the heat to the outside. Of course, it is also located on the outside unit of the split AC.



AC condenser (Photo Credit : tradekorea)

Expansion valve

The expansion valve, also known as a throttle device, is located between the two coils, the cooling coils of the evaporator and the hot coils of the condenser. It controls the amount of refrigerant moving towards the evaporator. Note that in the case of window ACs, the three components mentioned above are all located in a small metal box installed in a window opening.

These are the main components of an air conditioner.

AC operating principle of the air conditioner

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An air conditioner collects hot air from a particular room, processes it into itself with the help of a refrigerant and a series of coils, and then releases cool air into the same room where the hot air was originally collected. This is basically how all air conditioners work.

Debunking the myth

Many people believe that an air conditioner, with the help of machines installed in it, generates cooled air, which can cool a room so quickly. This might also explain why it consumes so much electricity. In reality, however, this is a mistake. An air conditioner is not a magical device; it only uses some physical and chemical phenomena very effectively to cool a particular room.

What happens when you turn on the air conditioning?

When you turn on an air conditioner and set the desired temperature, say 20 degrees Celsius, the thermostat installed in it will detect that there is a difference between the temperature of the room air and the temperature you have chosen.

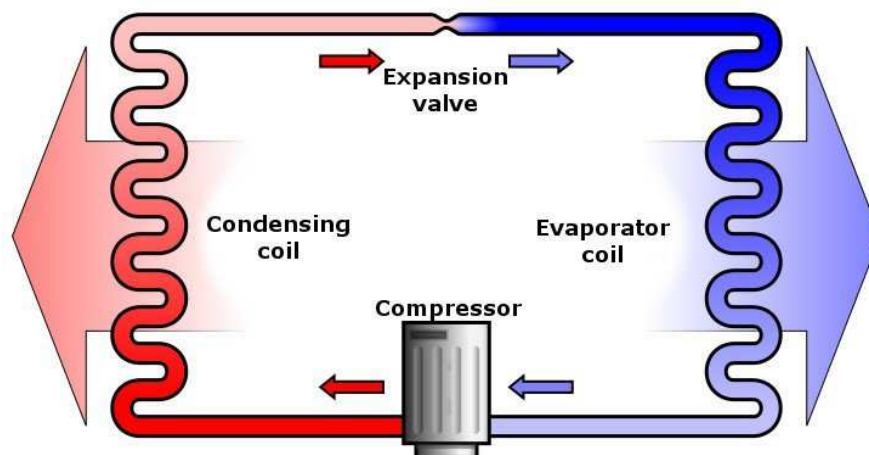
This warm air is sucked in through a grill at the bottom of the indoor unit, which then flows through some pipes through which the refrigerant, i.e. a coolant, flows. The refrigerant fluid absorbs the heat and itself becomes a hot gas. Thus, heat is removed from the air that falls on the evaporator coils. Note that the evaporator coil not only absorbs heat, but also flushes moisture out of the incoming air, which helps to dehumidify the room.

This hot refrigerant gas is then passed on to the compressor located on the outside unit. True to its name, the compressor compresses the gas so that it becomes hot as the compression of a gas increases its temperature.

This hot high-pressure gas then reaches the third component – the condenser. Here, too, the condenser stays true to its name and condenses the hot gas into a liquid.

The refrigerant enters the condenser as a hot gas but quickly becomes a cooler liquid because the heat from the “hot gas” is dissipated into the environment through metal fins. As a result, the refrigerant loses its heat as it leaves the condenser and becomes a cooler liquid. This flows through an expansion valve – a tiny hole in the system’s copper tube – which controls the flow of the cool liquid refrigerant into the evaporator, so that the refrigerant arrives at the point where its journey began.

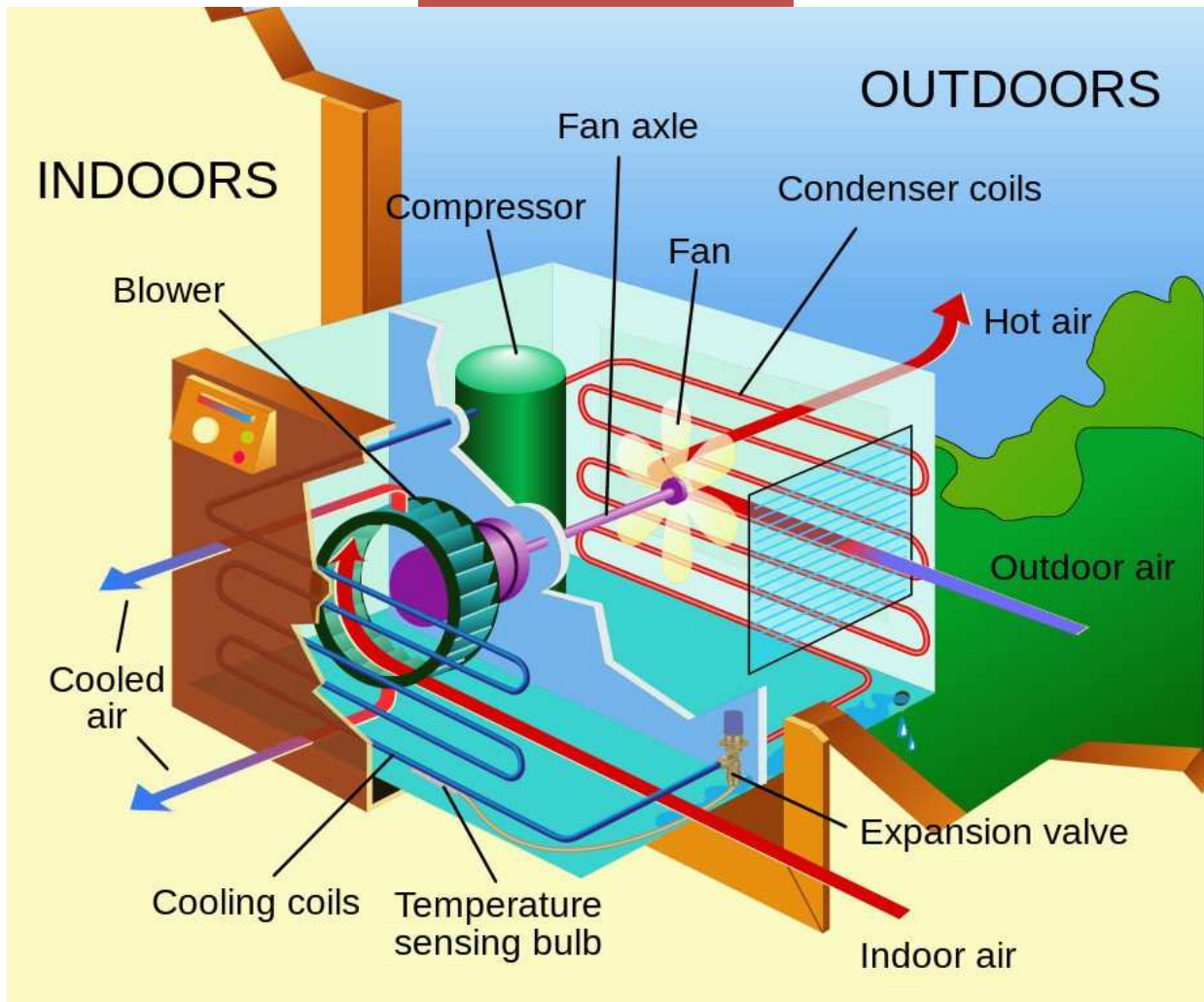
Here is a simplified diagram of the process:



(Photo Credit : Ilmari Karonen / Wikipedia Commons)

Although all components involved in the air conditioning process in window ACs are in the same metal box, the underlying cooling process remains exactly the same.

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Parts of a window air conditioner. (Photo Credit: Wikipedia)

The whole process repeats itself again and again until the desired temperature is reached. In short, an air conditioner sucks in warm air, again and again, cools it and pushes it back into the room until there is no warm air left to cool down.

Link of an article:

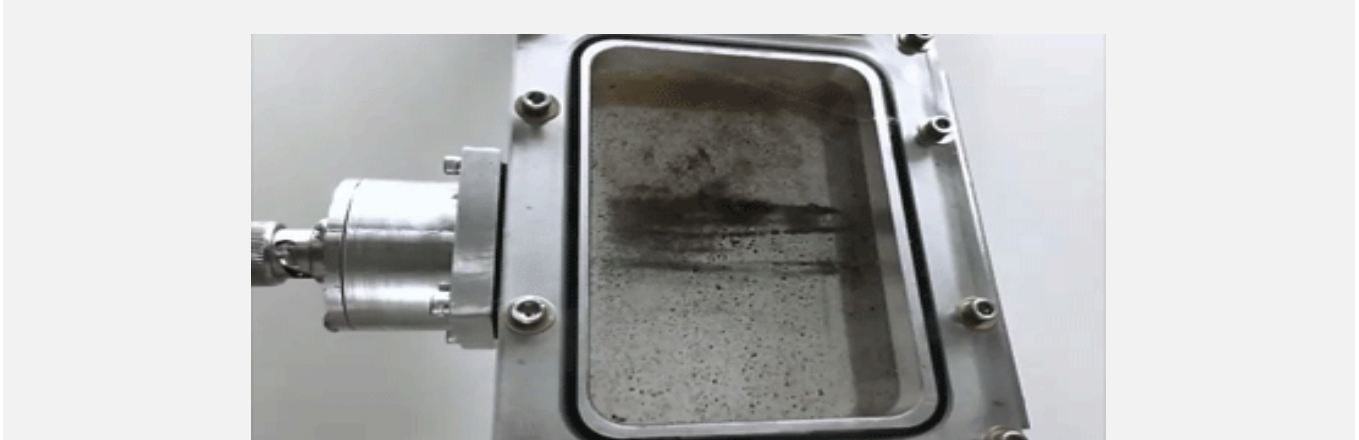
<https://www.scienceabc.com/innovation/air-conditioner-ac-work.html>

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Acoustic technique presents fresh take on water treatment

Mr. Shriganesh Jagdale, BE Mechanical

Technology could solve longstanding problem of separating suspended contaminants from water.



When oil and gas are extracted from the Earth, water also comes to the surface. Known as produced water, it contains naturally occurring hydrocarbons, salt, bacteria, radioactive material and other compounds, as well as any chemical additives used to ease extraction.

Each year, the U.S. alone generates more than 21 billion barrels (approximately 900 billion gallons) of produced water from oil and gas extraction, including hydraulic fracturing. To treat this water before disposal or re-use, the industry depends on filtration and separation technologies.

Typically, dispersed particles or droplets are removed from a host liquid using a series of complex techniques. These techniques are energy-intensive and may require the addition of chemicals to work. They have also proven inefficient at removing the tiniest oil droplets and contaminants.

With funding from the National Science Foundation (NSF), FloDesign Sonics, a small business based in Wilbraham, Massachusetts, has developed a new, efficient separation technology that can help clean produced water. The company's design uses acoustic waves to continuously capture and separate substances from water or other liquids without using filters or chemicals.

FloDesign Sonics demonstrated their separation technology at the White House Water Summit March 22.

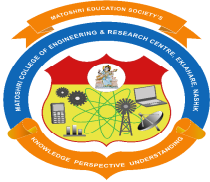
Sound separation

At the heart of FloDesign Sonics' system is a method called acoustophoresis, in which droplets or particles within a liquid can be manipulated with a special acoustic wave pattern. The new system uses a pattern of ultrasonic waves in the megahertz range.

The wave pattern exerts acoustic forces that bind substances dispersed in the liquid into clusters. Depending on their relative density compared to the liquid, these larger clusters either settle to the bottom or rise to the surface, where they can be separated easily.

"Acoustophoresis has been used primarily in microfluidics and other microscale systems," explained Jason Dionne, co-founder and senior engineer of FloDesign Sonics. "When the U.S. Army was looking for a technology for rapid detection of anthrax spores in large bodies of water, we got the idea to develop an acoustic separation technology that works at the macroscale."

FloDesign Sonics' patented system, called Acoustic Wave Separation (AWS), was designed to treat produced water from hydraulic fracturing (fracking) operations that extract natural gas. The amount



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of produced water generated at a fracking site changes over the lifetime of the well and depends on the geologic formation, but can reach 100,000 gallons per day.

"It's challenging for current technologies to remove particles smaller than 20 microns without the addition of chemicals," Dionne said. "AWS separates particulates, oil droplets, sand and bacteria as small as 1 micron."

Produced water treated with the AWS system meets or exceeds the Environmental Protection Agency's standards for safe discharge.

"With NSF funding, we have scaled up our technology to an industrially relevant scale," Dionne said.

"We now have a 7,000-gallon per day prototype that we are ready to pilot with a partner. The ultimate goal for our technology within the oil and gas industry is to build a system capable of processing 100,000 gallons per day.

Dionne said that compared to current methods for treating produced water, the AWS system would reduce energy and chemical usage by up to 75 percent.

Beyond oil and gas

FloDesign Sonics' proprietary technology has potential for separations in many sectors beyond oil and gas. One sector showing special promise is life science. Not only is the technique gentle on living cells, which can be damaged when separated by traditional methods, it also is able to separate particles of any size, overcoming a limitation of current filtration techniques. The company can picture the technology being used one day for cleaning and transfusing a patient's own blood during surgery. In the nearer term, AWS may be used to recover biological products from mammalian cells, which requires a purification process with high yield, product consistency and reproducibility. In April 2016, FloDesign Sonics will introduce its first product, a system that harvests therapeutic proteins and antibodies for biopharmaceutical manufacturing. Later in 2016, the company will introduce a second product, designed for continuous production of proteins from mammalian cell cultures. The company is currently investigating applications in the growing field of cell and gene therapies. AWS technology was developed with \$1.6 million in NSF funding through the Small Business Innovation Research (SBIR) program. FloDesign Sonics currently holds nine patents and has raised more than \$25 million in private sector funding. The company has grown from one employee in 2012 to 28 full-time employees today.

"FloDesign Sonics' research has led to an elegant and efficient method to accomplish difficult separations, which could impact a broad spectrum of manufacturing and production processes," said Prakash Balan, a program director for the NSF SBIR program. "NSF invests in small businesses like FloDesign Sonics to help promising high-tech concepts make it to the marketplace."

Link of an article:

https://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=138062&org=NSF

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The top power technology innovations and breakthroughs from

Mr. Vinay Gadgil, Student-BE Mechanical

The majority of power technology innovations and breakthroughs in 2013 occurred in the renewable sector. Power-technology.com lists some of 2013's major innovations and breakthroughs in energy technology.

Ultra-efficient photovoltaic designs



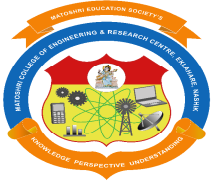
A four-junction solar cell, developed by Germany's Freiburg-based Fraunhofer Institute for Solar Energy Systems, Soitec and two other research organisations, achieved a record breaking 44.7% efficiency converting sunlight to electricity in September 2013. The solar cell structure comprised four solar sub-cells made from different semiconductor materials, each designed for absorbing different wavelength ranges of the solar spectrum.

Prior to this breakthrough, a team led by Dr Harry Atwater, a physicist at California Institute of Technology, developed an ultra-efficient solar design prototype integrating a multi-junction cell concept using spectral beam splitting technology. The design enables efficient splitting of the sunlight spectrum into six to eight component wavelengths, each producing a different colour of light. Each colour of light passes through a cell made of a specific semiconductor that can absorb it. The design is believed to be capable of a minimum 50% conversion efficiency.

The prototype design used a reflective metal to collect sunlight and direct it at a specific angle to the solar panel with multiple solar cells. The broad spectrum sunlight is split into different colours as it passes through the structure, encountering a series of optical filters. Atwater's team is also working on two other designs based on this path-breaking concept. One of these uses nanoscale optical filters to filter light coming from all angles. The other uses a hologram instead of filters to split the spectrum. Which of these designs will offer the best performance remains to be seen.

Breakthroughs in HVDC transmission

The Swiss-based power and automation company ABB introduced its fourth generation HVDC light transmission system, which is designed for underground and subsea transmission with a record high $\pm 320\text{kV}$ voltage-sourced converter. The voltage level achieved in this system was 50% higher than the previous record set by ABB itself.



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This is the latest breakthrough in HVDC technology paving the way for the evolution of interconnected HVDC super grids. In late 2012, ABB announced the development of a hybrid HVDC circuit breaker, which is critical for the reliable operation of interconnected HVDC grids. The HVDC circuit breaker can disconnect parts of the grid experiencing problems while ensuring continuous transmission in the rest of the grid.

ABB also created a simulation centre to develop controls for DC grids including DC to AC conversion stations. High-voltage DC power has traditionally been used for point-to-point transmission, and integrated transmission networks have been predominantly operated using AC power. These breakthroughs lead to the development of integrated HVDC networks that could efficiently route power from far-flung places to any part of the world with significantly less power-conduction loss.

Flow battery technology for low-cost and large-scale renewable energy storage

Researchers at Massachusetts Institute of Technology (MIT) designed a low-cost, rechargeable flow battery without expensive membranes to generate and store renewable electricity on a large scale. A prototype of this innovative battery technology demonstrated significantly higher performance than most lithium-ion batteries and other commercial and experimental energy-storage systems.

“Researchers at Massachusetts Institute of Technology (MIT) designed a low-cost, rechargeable flow battery without expensive membranes to generate and store renewable electricity on a large scale.”

The reactants used in the storage device are a less expensive liquid bromine solution and hydrogen fuel. The device uses laminar flow technology, which allows the liquids to undergo electrochemical reactions between two electrodes in two separate parallel streams without a membrane.

In January 2014, a team of scientists and engineers from Harvard demonstrated a new flow-battery technology using organic molecules called quinones abundantly available in crude oil and green plants, instead of precious metal electrolytes such as Vanadium and Platinum. The new flow-battery technology offers a cost-effective means of storing large-scale renewable energy generated from wind and solar sources in the grid.

Floating wind energy storage

MIT researchers developed an approach to store and use on-demand the electricity generated by floating wind farms. The new technology represents a major leap in mitigating the intermittent and unpredictable nature of offshore wind power generation.

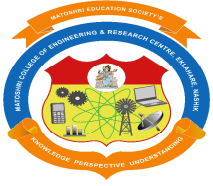
The new offshore wind power storage concept involves the erection of a 30m diameter hollow-concrete sphere with 3m of wall thickness on the sea floor under the wind turbine, which can serve as an anchor to moor the floating turbines while also helping to store the extra energy produced.

The concept envisages a pump attached to the underwater structure, which can be driven by excess wind energy, to pump sea water from the hollow sphere. Water can be allowed to flow back into the sphere through a turbine attached to a generator when needed. The sphere can also be used to store energy from other sources as the system can be connected to the grid.

Breakthrough developments in nuclear fusion technology

Research in the area of nuclear fusion technology development reached a new milestone in September 2013, as an experiment by scientists at the National Ignition Facility, Livermore, California, confirmed that the amount of energy released from nuclear fusion reaction could be more than the energy absorbed by the fuel.

The nuclear fusion technology involves power generation through fusion of two or more lighter atoms to a larger one, unlike the conventional nuclear fission technology whereby energy is released through the



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splitting of atoms. The particles released by fusion are believed to be less radioactive but more energy-producing than those released by fission.

The commercial viability of the fusion technology may be a reality in the near future with ongoing innovations in the field. The world's biggest experimental nuclear fusion reactor, called ITER, is being developed in the French scientific research centre Cadarache as a joint project of multiple countries including the US, Russia, India and Japan. The superconductivity research group of the University of Twente towards the end of 2013 developed a superconducting cable system which can help create a magnetic field strong enough to control the enormously hot plasma in the fusion reactor core.

Underwater kites for low-velocity tidal power generation

Swedish marine energy technology company Minesto developed a new generation technology to harness power from low-velocity tidal currents. The new technology uses a device called "Deep Green" that looks like an underwater kite. The technology opens up the opportunity for ocean power generation from many potential sites around the world, which cannot otherwise be exploited with existing technologies.

"Minesto is planning a full-scale installation of Deep Green with 3MW capacity in 2015."

The innovative marine power device is equipped with a hydrodynamic wing and a gearless turbine anchored to the ocean bed with a tether. The device is allowed to float at least 20m below the water surface along a controlled trajectory to maximise energy output. Water passing over the device lifts up the wing and rotates the turbine to generate electricity.

A pilot project based on this technology started power production towards the end of 2013 off Strangford Lough in Northern Ireland. It demonstrates the ability to produce power from currents with velocity of less than 2.5m/s. Minesto is planning a full-scale installation of Deep Green with 3MW capacity in 2015.

Multiple-zone stimulation from single wellbore for enhanced geothermal system

The enhanced geothermal systems (EGS)-focused renewable energy development company AltaRock Energy achieved a major breakthrough by creating multiple stimulated zones from a single well at the Newberry EGS demonstration site in Bend, Oregon, US. The new technique paves the way for cost-competitive electricity generation from EGS.

EGS are the geothermal reservoirs created by drilling wells deep into the ground and fracturing the hot rocks by injecting cold water. Injected water, heated by contact with the hot rock, is brought to surface for through production wells. The EGS technology expands the scope of geothermal energy exploitation from different geographical locations, unlike the traditional geothermal systems that are limited to places with naturally occurring geothermal reservoirs.

The multiple-zone stimulation technique with the use of a single well can lower the cost of EGS energy production by approximately 50%. The technique involves the use of thermally degradable zonal isolation materials (TZIM), AltaRock Energy's patented materials made from a biodegradable non-toxic polymer. TZIM added to the injection water propels stimulation from one zone to the other.

Hydrogenie power generator passes trials successfully

GE announced the successful trial of its innovative compact power generation technology "Hydrogenie" in Rugby, England, in April 2013. The technology allows for higher electricity generation from renewable resources, such as water and wind, using superconductors running at relatively high temperatures.

The 1.7MW Hydrogenie generator spinning at 214rpm makes use of high-temperature superconductors (HTS) rather than copper for the rotor windings on the motor. Although superconductivity for similar

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purposes could only be achieved at approximately 4 Kelvin (-269°C), the new HTS power generation technology demonstrated its capacity to run at temperatures up to 50 Kelvin (-223.15°C).

The Hydrogenie generator features a cryonic cooling system, thermal insulation and a rotor located inside a vacuum. The breakthrough could lead to the development of more efficient superconducting machines for power generation. The technology can also help in upgrading older run-of-river power plants, as well as the high-torque and slow-speed wind machines in use.

Link of an article:

<https://www.power-technology.com/features/featurethe-top-power-technology-innovations-and-breakthroughs-from-2013-4181058/>



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The Shift To Smart Factories: 7 Manufacturing Innovation Trends

Roshan Divate, BE Mechanical

Today, innovation has been permeating all facets of our life. Manufacturing is one of the most vivid examples of the inevitable power of innovations and industrial breakthrough. We're already on the verge of **Industry 4.0** driven forward by innovations in automation, AI, and IoT. No doubt, the way factories operate is constantly changing, leaving significant footprint on the world around



What does Industry 4.0 stand for?

Industry 4.0 presupposes integration of manufacturing automation and data exchange to encourage innovations and smart factory. Such factories will be controlled by a virtual production line that runs systems and monitors and completes their physical processes. Communicating in real time and ensuring the quality of its operations, connected software systems will be running physical manufacturing automatically. So, it's quite logic that smaller, more agile companies are the ones rapidly innovating in the world of manufacturing.

Whitepaper: Bridging the OT/IT gap. Towards a connected industry 4.0

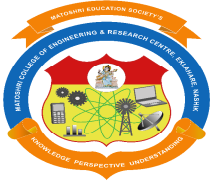
Invention or innovation?

It's important to distinguish between inventions and innovations. **Invention is a subset of innovation.** The power of innovation lies in new value creation on a commercial scale. **When an invention is exploited successfully commercially, it becomes an innovation.** For instance, the electric bulb is a great invention, but producing them in bulk, and serving millions of customers is what made it an innovation.

Innovation also can be defined as something that adds value to what you are already doing, in a unique, unprecedented way which has the potential to add value to the community/ stakeholders.

The cornerstones of manufacturing innovation

Innovations strategy and culture serve for encouraging innovations in a thoroughly-tailored systematic way. The creation of a culture of innovation helps the cause of serial innovation. To successfully create and commercialise inventions, companies must commit themselves to the process of innovation.



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Favorable atmosphere for innovations is of crucial importance, for it's exactly what makes creativity to prosper, boosting innovations as a consequence.

Design is the first outside manifestation of an innovation that gives life to an innovation in future. Without a design, an innovation remains in the mind of the innovator.

Value delivery through innovation. Engineering makes production on a large scale possible, allowing it to become transferable to many locations, letting the finished product reach the masses. **Engineering and production are the most important means to deliver on the promise.**

So, what are 7 manufacturing innovation trends that are powering the shift to smarter factories?

1. Virtual manufacturing

In any manufacturing process, being able to do something exactly right the first time is ideal. Knowing precisely what an outcome will be, based on the decisions, can eliminate any wasted time or resources, by being able to essentially **manufacture something virtually**. That is, **a team can perform its manufacturing process digitally, with each step of the process done visually in a near-animated process.**

They can understand how the procedure will go before the actual physical manufacturing takes place. This process is already under way in many industries, including auto manufacturing. It's allowing companies to save money, simplify operations and get products to market much faster than ever before. For instance, Boeing, has already started using augmented reality in their assembly processes. They've been using Google Glass and Skylight software to give technicians valuable insight and instructions when completing complicated wiring tasks.

It's likely that other industries will adopt similar uses for the technology, allowing their output to be built with the utmost precision.

2. Micro manufacturing and machine vision error detection

Micro manufacturing is used to create the tiny components in a variety of different devices, including cutting-edge medical equipment that allows doctors to treat patients without resorting to invasive surgery. With technology as mobile and lightweight as it is, the micro molding process is the essential method for creating the internal machinery that designers are dependent on to create these products.

On the other hand, new technologies are allowing us to **detect faults in production processes**. To illustrate, **Landing.AI** is a company that creates smart technology that can find the tiniest of faults in circuitry of a machine that might not be immediately apparent to a human. As **machinery in smart factories** will all be connected and communicating with each other, the AI will send an alert when a fault is found, immediately halting the machine in question so that it can be fixed.

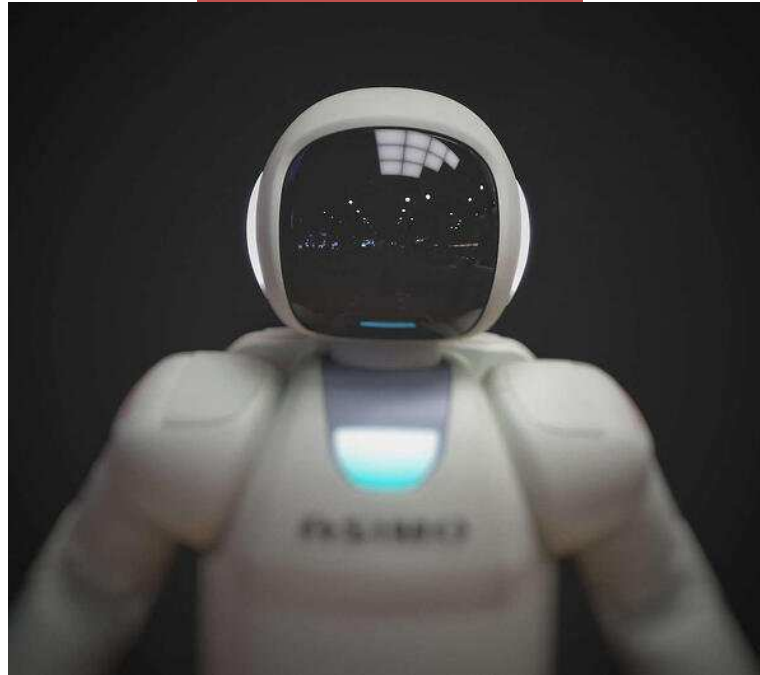
3. Industrial robotics

Today, **industrial robots** are very sophisticated with the ability to be easily programmed to handle more than just a single, repetitive job.

Thus, in 2015 **General Motors** announced that they would be adopting a robotic glove designed by NASA, for use by their factory workers. The glove is based on a design that was created for use on the International Space Station. There are numerous benefits of such a glove for the workers, including strain reduction for the workers' arms and better grip when lifting heavy items.

While robot workers are becoming increasingly common, human workers are likely to wear robotic implements like these gloves to aid in their work in future.

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4. Sensors on the workplace

With factories gradually filling with autonomous machines, it's imperative that there are proper structures in place to prevent any accidents. One key component of this is **sensors which allow machine-to-machine communication.**

For example, **TE Connectivity** is a company producing sophisticated sensors that transmit data between industrial machines and smart devices, keeping everything running smoothly.

5. Fully automated warehouses and smart recycling

The **Ocado Warehouse** is a perfect example of the warehouses of the future. The automated warehouse is staffed by a team of robots that empty, transport, and replace batches of products. Once the robots have chosen and transported products to a picking station, the products are then prepared for shipping by other robots and human workers.

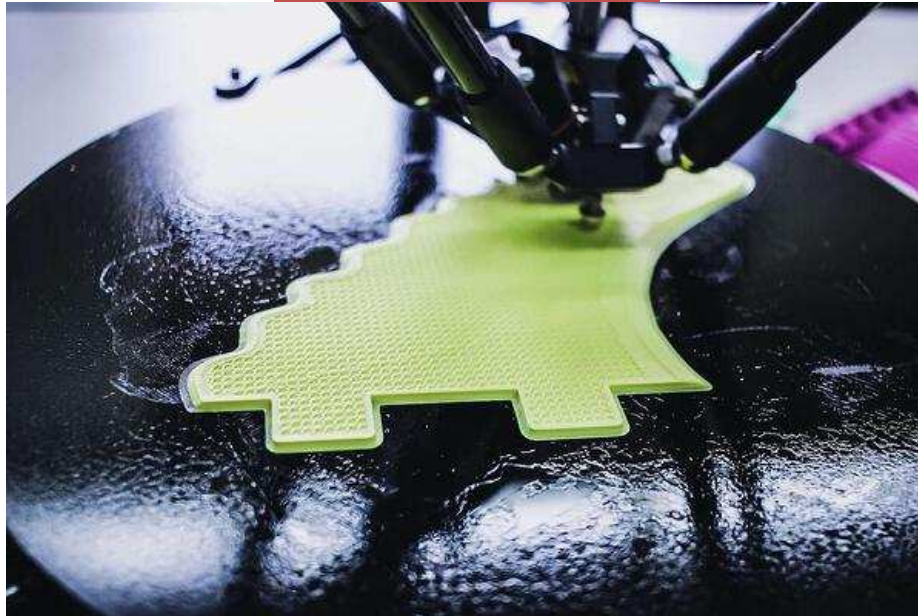
Another example is **Apple's** recycling robot Daisy that can strip apart iPhones and allow the materials to be reused. Such types of robots allows customers to safely dispose of their discarded smart devices. Secondly, it reduces the resources spent on sourcing the materials for new devices, as the materials can be taken from older models and reused.

6. 3D printing The “printing” is actually manufacturing of a tangible object from an alloy or plastic based on a 3D image imported into the printing machine. This process is changing the importance of funding in manufacturing and in how long it takes to bring a product to market.

Both businesses and consumers will be benefiting from these manufacturing innovation trends, as people's health and longevity are improved, communication becomes easier and manufacturing is simplified for a variety of companies.

MX3D's six-axis robot arm is one of the most exciting examples of 3D printing. Its arm can print and construct complicated metalwork in mid-air, from basically any angle. This improves not only the speed at which the parts or object can be produced, but also the structural integrity.

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7. Exoskeletons for workers to ensure safety at work

Full-body **exoskeletons** are another piece of wearable tech designed to protect workers and increase their strength. **It's the perfect compromise between an all-robot staff and protecting human jobs**, as it gives human workers advantages in strength and stability usually reserved for their mechanical counterparts.

The **Ekso vest** is just one example of an exoskeleton designed for factory workers. The vest is already in use in a number of Ford factories, and employees have praised the device for allowing them to conserve physical energy throughout the workday while allowing them to lift weights that they otherwise would be unable to manage.

Conclusion: What's next?

We live in the era of constant transformations. Ability to be flexible and agile is one of the key qualities for success. Product and process innovation have been altering manufacturing already for decades. It goes without saying that the future will witness even more breathtaking technological disruptions, as research around nanotechnology and analytics start to impact numerous **manufacturing applications**.

Companies with an innovation edge featuring a clearly developed **forward-thinking approach and readiness to rapidly adapt to innovative technology** will have a strong competitive advantage. Only strong players will get a chance to fulfill established goals, provide goods and services for untapped markets, and, finally, to stay ahead of the competition!

Link of an article:

<https://blog.datumize.com/7-manufacturing-innovation-trends-that-power-the-shift-to-smarter-factories>

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