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A REVIEW ON GREEN CONCRETE

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ABSTRACT

Green Concrete is a environmental friendly material. Normal concrete is responsible for release of carbon dioxide to some extent. To reduce such emissions, various types of concrete were developed by various researchers by using some waste products from industries and agriculture. It depicts the convenience of the usage of various by products such as dust, marble, fly ash, plastic waste, marble granules, silica fumes, blast furnace, slag, etc. which requires less amount of energy and it is also less harmful to environment. Green Concrete is capable for sustainable development by the application of industrial waste to reduce the consumption of natural resources and energy etc. Use of such materials saves approximately 20% of cements. Thus, green concrete is an excellent substitute of cement as it is cheaper, due to which it is made up of waste products, saving energy. Green Concrete has greater strength & durability compared to normal concrete. KEYWORDS: Concrete, aggregates, sustainability, durability, fly ash, supplementary cementious materials.

KEYWORD*: - Green concrete, recycled, cement, coarse and fine aggregates*

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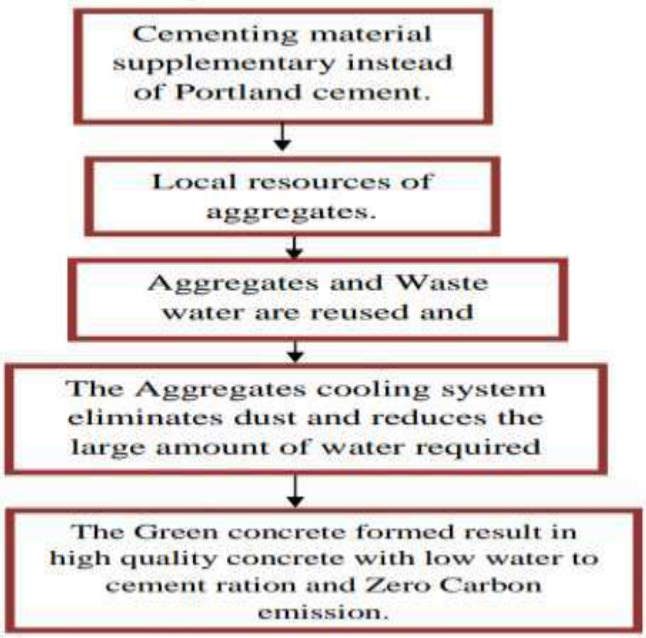
1. INTRODUCTION

The huge construction growth boosts demand for construction materials. Aggregates are the main constituent of concrete. Due to continuously mining the availability of aggregates has emerged problems in recent times. To overcome this problem, there is need to find replacement to some extent.

Green concrete has nothing to do with colour. This is a concept of eco friendly way in mass concreting. The constituent of this concrete doesn't correspond to carbon footprint and give healthy environment to all. Green concrete is also cheap to produce because, waste products are used as partial substitute for cement, charges for the disposal are avoided, energy consumption in production is lower, and durability is greater. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste deposits



2. PROPERTIES OF GREEN CONCRETE

A. It improves Mechanical properties like strength, shrinkage, static behaviour, etc.
B. Fire resistance (I.e. heat transfer), etc.
C. It improves the workability.
D. It improves strength development.
E. It improves the curing properties.
F. It improves durability.
G. It improves corrosion protection.
H. It improves frost.
I. It improves new deterioration mechanism.
J. It improves environmental impact

Table: Material replaced Concrete Green Concrete

Sr No.	Components of Concrete	Replaced material for Green Concrete
1	Cement	Sludge ash, fly ash, etc
2	Coarse Aggregates	Silica fume, waste glass, etc.
3	Fine Aggregates	Demolished bricks, quarry dust, micro silica, marble, sludge powder, etc.

3. MATERIAL/PRODUCT SELECTION

A. Efficiency of Resources:
It mainly includes properties like natural recycled content/renewable recycled content, efficient resource manufacturing process, refurbished or reusable and durability.

B. Energy Efficiency:
The energy required to make this concrete is known as energy efficiency. The materials which require the amount of energy during the construction period of the concrete ate mostly preferred.

C. Conservation of Water:
Water is mainly conserved by using materials that help us and conserve water in landscape areas or even help to reduce the consumption of water in building materials

4. RAW MATERIAL USED IN GREEN CONCRETE

Fly ash: - Fly ash is finely divided residue resulting from the combustion of powdered coal and transported by flue gases and collected by electrostatic precipitation. Fly ash is most used pozzolanic material all over the world. The volume of fly ash produced is about 75 million tons per year.

Marble sludge powder:-This requires a threadbare rethinking on ways and means of providing shelter and infrastructure for the community. Perhaps there is a necessity of making a concerted movement for developing innovative and alternative novel material for construction. Green Concrete is capable for sustainable development is characterized by application of industrial waste such as marble powder, quarry dust, wood ash, paper pulp.

Recycle aggregate:- recycled coarse aggregates showed that physical and mechanical properties are of inferior quality and improvement in properties was observed after washing due to removal of old weak mortar adhered on its surface. The influence of natural coarse aggregates replacement (50 and 100%) with recycled coarse aggregate on various mechanical and durability properties of hardened concrete were discussed and compared with controls at different w/c ratio

Ground Granulated Blast Furnace Slag
It is an excellent cementitious material. Slag is obtained by crushing molten iron slag which is nothing but a by product of iron and steel making from a blast furnace in water or steam, to make a granular glassy product that

is then dried and grounded into a fine powder. Similar to fly ash, even GGBFS generates less heat of hydration. GGBFS is also responsible for improving durability as well as mechanical properties of concrete.

5. ADVANTAGES OF GREEN CONCRETE

A. It has good thermal resistance.
B. It has good acid resistance.
C. It increases compressive strength.
D. It increases split tensile strength.
E. Reduce consumption of the cement.
F. Reduce the environmental pollution.
G. It is cheaper.

6. DISADVANTAGES OF GREEN CONCRETE

- It has less structure construction.
- It has less flexural strength.
- Water absorption is high.
- Shrinkage is high.
- Creep is high.

7. CONCLUSIONS

· There is significant potential in waste materials to produce green concrete.

· The replacement of traditional ingredients of concrete by waste materials and by products gives an opportunity to manufacture Economical and environment friendly concrete.

· Partial replacement of ingredients by using waste materials and admixtures shows better compressive and tensile strength, improved sulphate resistance, decreased permeability and improved workability.

· The cost per unit volume of concrete with waste materials like quarry dust is lower than the corresponding control concrete mixes.

· A detail life cycle analysis of green concrete by considering various parameters is very much necessary to understand the resultant concrete properties

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A Review on the water pollution to purification

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ABSTRACT

Water is the major source of drinking for all living organism and human being now days. Water pollution and potable water scarcity are two issues which have been in the limelight for so many decades. Rapid industrialization, demographic explosion, and unscientific water resource management are the major reasons for the situation. A wide array of pollutants from nutrients (nitrates and phosphates) to contaminants of emerging concern is affecting the quality of global water resources. All these issues are of particular concern in India too. In this context, water pollution and treatment technologies are two important areas of interest. The involvement of several sophisticated equipments in recent years helped to detect trace amount of pesticides, pharmaceuticals and personal care products, heavy metals, and other emerging pollutants in water bodies. A wide variety of water treatment technologies are also being developed. However, an economically viable as well as highly efficient water treatment technique for treating all the chemical water contaminants is still under intense research. On the other hand, it is really a paradox that when there is a cry for cheaper water purification technologies, a high price is being given to tackle water borne diseases.

Keyword: *Water Pollution, Waste, Water Treatment, Pure Water***.**

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1. Introduction

Water is one of the renewable resources essential for sustaining all forms of life, food production, economic development, and for general well being. It is impossible to substitute for most of its uses, difficult to de pollute, expensive to transport, and it is truly a unique gift to mankind from nature. Water is also one of the most manageable natural resources as it is capable of diversion, transport, storage, and recycling. All these properties impart to water its great utility for human beings. The surface water and groundwater resources of the country play a major role in agriculture, hydropower generation, livestock production, industrial activities, forestry, fisheries, navigation, recreational activities etc. The freshwater ecosystems of the world comprise only about 0.5% of the earth's surface and have a volume of 2.84x105 Km3. Rivers constitute an insignificant amount (0.1%) of the land surface. Only 0.01% of the waters of the earth occur in river channels. Inspire of these low quantities, running waters are of enormous significance (Wetzel, 2001). India receives annual precipitation of about 4000 km3, including snowfall. Out of this, monsoon rainfall is of the order of 3000 km3. Rainfall in India is dependent on the south-west and north-east monsoons, on shallow cyclonic depressions and disturbances and on local storms (Kumar et. al., 2005). Most of it takes place under the influence of south-west monsoon between June and September except in Tamil Nadu, where it is under the influence of north-east monsoon during October and November (Kumar et. al., 2005). India is gifted with river system comprising more than 20 major rivers with several tributaries. Many of these rivers are perennial and some of them are seasonal. Although India occupies only 3.29 million km2 geographical area, constituting 2.4% of the world's land area, it supports over 15% of the world's population. The population of India as on 1st March 2001 stood at 1,027,015,247 persons. Thus, India supports about 1/6th of world population, 1/50th of world's land and 1/25th of world's water resources (Water Management Forum, 2003). In the last few decades, there has been a tremendous increase in the demand for freshwater due to rapid growth of population and the accelerated pace of industrialization (Ramakrishnaiah et al., 2009). Human health is threatened by most of the agricultural development activities particularly in relation to excessive application of fertilizers and unsanitary conditions (Okeke and Igboanua, 2003). Anthropogenic activities

related to extensive urbanization, agricultural practices, industrialization, and population expansion have led to water quality deterioration in many parts of the world (Baig et al. 2009, Mian et al., 2010, Wang et al., 2010). In addition, deficient water resources have increasingly restrained water pollution control and water quality improvement (Bu et al., 2010). Water pollution has been a research focus for government and scientists. Therefore, protecting river water quality is extremely urgent because of serious water pollution and global scarcity of water resources. Sources of water pollution: Water pollution can occur from two sources. 1. Point source and 2. Non-point source (Table 1). Point sources of pollution are those which have direct identifiable source. Example includes pipe attached to a factory, oil spill from a tanker, effluents coming out from industries. Point sources of pollution include wastewater effluent (both municipal and industrial) and storm sewer discharge and affect mostly the area near it. Whereas non-point sources of pollution are those which arrive from different sources of origin and number of ways by which contaminants enter into groundwater or surface water and arrive in the environment from different non identifiable sources. Examples are runoff from agricultural fields, urban waste etc. Sometimes pollution that enters the environment in one place has an effect hundreds or even thousands of miles away. This is known as transboundary pollution. One example is the radioactive waste that travels through the oceans from nuclear reprocessing plants to nearby countries. Water pollutants may be

i) Organic and

ii) Inorganic water pollutant.

a. Organic water pollutants: They comprise of insecticides and herbicides, organo halides and other forms of chemicals; bacteria from sewage and livestocks farming; food processing wastes; pathogens; volatile organic compounds etc.

b. Inorganic water pollutants: They may arise from heavy metals from acid mine drainage; silt from surface run-off, logging, slash and burning practices and land filling; fertilizers from agricultural run-off which include nitrates and phosphates etc. and chemical waste from industrial effluents.

Some of the important sources of water pollution are discussed below: Urbanization: Urbanization generally leads to higher phosphorus concentrations in urban catchments (Paul and Meyer, 2001). Increasing imperviousness, increased runoff from urbanized surfaces, and increased municipal and industrial discharges all result in increased loadings of nutrients to urban streams. This makes urbanization second only to agriculture as the major cause of stream impairment. Sewage and other Oxygen Demanding Wastes: Management of solid waste is not successful due to huge volumes of organic and non-biodegradable wastes generated daily. As a consequence, garbage in most parts of India is unscientifically disposed and ultimately leads to increase in the pollutant load of surface and groundwater courses. Sewage can be a fertilizer as it releases important nutrients to the environment such as nitrogen and phosphorus which plants and animals need for growth. Chemical fertilizers used by farmers also add nutrients to the soil, which drain into rivers and seas and add to the fertilizing effect of the sewage. Together, sewage and fertilizers can cause a massive increase in the growth of algae or plankton that facilitate huge areas of oceans, lakes, or rivers creating a condition known as algal bloom thereby reducing the dissolved oxygen content of water and killing other forms of life like fish. Industrial Wastes: Many of the industries are situated along the banks of river such as steel and paper industries for their requirement of huge amounts of water in manufacturing processes and finally their wastes containing acids, alkalies, dyes and other chemicals are dumped and poured down into rivers as effluents. Chemical industries concerning with manufacture of Aluminium release large amount of fluoride through their emissions to air and effluents to water bodies. Fertilizer industries generate huge amount of ammonia whereas steel plants generate cyanide. Chromium salts are used in industrial process for the production of sodium dichromate and other compounds containing chromium. All such discharges finally arrive at water bodies in the form of effluents affecting human health and the organism living there.

2. Agro-chemical Wastes:

In the agricultural sector, water and electricity for irrigation are subsidized for political reasons. This leads to wasteful flood irrigation rather than adoption of more optimal practices such as sprinkler and drip irrigation. Cropping patterns and farming practices also do not necessarily encourage the judicious use of water. There are losses of water due to breaches and seepage resulting in water logging and salinity. Agro-chemical wastes include fertilizers, pesticides which may be herbicides and insecticides widely used in crop fields to enhance productivity. Improper disposal of pesticides from field farms and agricultural activities contributes a lot of pollutants to water bodies and soils. Some of the pesticides are: DDT, Aldrin, Dieldrin, Malathion, Hexachloro Benzene etc. Pesticides reach water bodies through surface runoff from agricultural fields, drifting from spraying, washing down of precipitation and direct dusting and spraying of pesticides in low lying areas polluting the water quality. Most of them are non-biodegradable and persistent in the environment for long period of time. These chemicals may reach human through food chain leading to biomagnification. Nutrient enrichment: The sources of nutrients in surface water can be divided broadly into natural and anthropogenic types. Contribution to pollution by natural source is low due to balance established by the natural system between the production and consumption of nutrients over the course of time. Anthropogenic sources of contaminants are contributed from agriculture, domestic and industrial wastes. Nutrient concentrations in streams and rivers have been strongly correlated with human land use and disturbance gradients. Both N and P enrichment have links with the agricultural and urban land uses in the watershed. Fluxes of total N in temperate-zone rivers surrounding the North Atlantic Ocean are highly correlated with net anthropogenic input of N in their watersheds (Howarth et al., 1996). Total N and nitrate fluxes and concentrations in rivers are also correlated with human population density (Howarth et al., 1996). Nitrogen fertilization is the main source of N in streams and rivers (Goolsby and Battaglin, 2001). Similarly, nutrient enrichment of aquatic systems from anthropogenic sources includes point and nonpoint sources (Table 1. adapted from Carpenter et al., 1998). In contrast to point sources of nutrients that are relatively easy to monitor and regulate, nonpoint sources such as livestock, crop fertilizers, and urban runoff exhibit more spatial and temporal variability. Following strong regulation of point source inputs in response to the Clean Water Act, nutrients from nonpoint sources are now the major source of water pollution in the United States (Carpenter et al., 1998).

3. Thermal pollution:

Changes in water temperature adversely affect water quality and aquatic biota. Majority of the thermal pollution in water is caused due to human activities. Some of the important sources of thermal pollution are nuclear power and electric power plants, petroleum refineries, steel melting factories, coal fire power plant, boiler from industries which release large amount of heat to the water bodies leading to change in the physical, chemical and biological characteristics of the receiving water bodies. High temperature declines the oxygen content of water; disturbs the reproductive cycles, respiratory and digestive rates and other physiological changes causing difficulties for the aquatic life. Oil spillage: Oil discharge into the surface of sea by way of accident or leakage from cargo tankers carrying petrol, diesel and their derivatives pollute sea water to a great extent.Exploration of oil from offshore also lead to oil pollution in water. The residual oil spreads over the water surface forming a thin layer of water-in-oil emulsion. The disruption of sediments: Construction of dams for hydroelectric power or water reservoirs can reduce the sediment flow affecting adversely the formation of beaches, increases coastal erosion and reduces the flow of nutrients from rivers into seas (potentially reducing coastal fish stocks). Increased sediment flow can also create a problem. During construction work, soil, rock, and other fine powders sometimes enter nearby rivers in large quantities, causing water to become turbid (muddy or silted). The extra sediment can block the gills of fish, causing them suffocation.

4. Acid rain pollution:

Water pollution that alters a plant's surrounding pH level, such as due to acid rain, can harm or kill the plant. Atmospheric Sulfur dioxide and nitrogen dioxide emitted from natural and human-made sources like volcanic activity and burning fossil fuels\interact with atmospheric chemicals, including hydrogen and oxygen, to form sulfuric and nitric acids in the air. These acids fall down to earth through precipitation in the form of rain or snow. Once acid rain reaches the ground, it flows into waterways that carry its acidic compounds into water bodies. Acid rain that collects in aquatic environments lowers water pH levels and affects the aquatic biota.

Radioactive waste: Radioactive pollution is caused by the presence of radioactive materials in water. They are classified as small doses which temporary stimulate the metabolism and large doses which gradually damage the organism causing genetic mutation. Source may be from radioactive sediment, waters used in nuclear atomic plants, radioactive minerals exploitation, nuclear power plants and use of radioisotopes in medical and research purposes. Introduction of Alien species in some parts of the world, alien species also known as invasive species are a major problem of water pollution. Outside their normal environment, they have no natural predators, so they rapidly spread and dominate the animals or plants that thrive there. Common examples of alien species include zebra mussels in the Great Lakes of the USA, which were carried there from Europe by ballast water (waste water flushed from ships). The Mediterranean Sea has been invaded by a kind of alien algae called Caulerpa taxifolia. In the Black Sea, an alien jellyfish called Mnemiopsis leidyi reduced fish stocks by 90 percent after arriving in ballast water. In San Francisco Bay, Asian clams called Potamocorbula amurensis, also introduced by ballast water

Wastewater treatment is a process used to remove contaminants from wastewater or sewage and convert it into an effluent that can be returned to the water cycle with acceptable impact on the environment, or reused for various purposes (called water reclamation).[1] The treatment process takes place in a wastewater treatment plant (WWTP), also referred to as a Water Resource Recovery Facility (WRRF) or a Sewage Treatment Plant (STP) in the case of domestic wastewater. Pollutants in wastewater are removed, converted or broken down during the treatment process.

The treatment of wastewater is part of the overarching field of sanitation. Sanitation also includes the management of human waste and solid waste as well as storm water (drainage) management. The main by-product from wastewater treatment plants is sewage sludge which is usually treated in the same or another wastewater treatment plant. Biogas can be another by-product if anaerobic treatment processes are used.

Fig -1: Anaerobic Treatment

5. Processes

The processes involved in waste-water treatment include physical processes such as settlement or flotation and biological processes such as aerated lagoons, activated sludge, or bio-films in trickling filters. Other physical methods such as filtration through sieves may be used in specialised circumstances such as de-watering waste-water sludge.

To be effective, sewage must be conveyed to a treatment plant by appropriate pipes and infrastructure, and the process itself must be subject to regulation and controls. Some wastewaters require specialized treatment methods. At the simplest level, treatment of sewage and most wastewaters is carried out through separation of solids from liquids, usually by sedimentation. By progressively converting dissolved material into solids, usually a biological floc, which is then settled out, an effluent stream of increasing purity is produced.

5.1. Phase separation

Phase separation transfers impurities into a non-aqueous phase. Phase separation may occur at intermediate points in a treatment sequence to remove solids generated during oxidation or polishing. Grease and oil may be recovered for fuel or saponification. Solids often require dewatering of sludge in a wastewater treatment plant. Disposal options for dried solids vary with the type and concentration of impurities removed from water.

Fig -2: Primary settling tank of wastewater treatment plant in Dresden-Kaditz, Germany

5.2. Sedimentation

Solids such as stones, grit, and sand may be removed from wastewater by gravity when density differences are sufficient to overcome dispersion by turbulence. This is typically achieved using a grit channel designed to produce an optimum flow rate that allows grit to settle and other less-dense solids to be carried forward to the next treatment stage. Gravity separation of solids is the primary treatment of sewage, where the unit process is called "primary settling tanks" or "primary sedimentation tanks."It is also widely used for the treatment of other types of wastewater. Solids that are denser than water will accumulate at the bottom of quiescent settling basins. More complex clarifiers also have skimmers to simultaneously remove floating grease such as soap scum and solids such as feathers, wood chips, or condoms. Containers like the API oil-water separator are specifically designed to separate non-polar liquids.

5.3. Oxidation

Oxidation reduces the biochemical oxygen demand of wastewater, and may reduce the toxicity of some impurities. Secondary treatment converts organic compounds into carbon dioxide, water, and biosolids. Chemical oxidation is widely used for disinfection.

Fig -3: Treatment Plant

5.4. Biochemical oxidation

Secondary treatment by biochemical oxidation of dissolved and colloidal organic compounds is widely used in sewage treatment and is applicable to some agricultural and industrial wastewaters. Biological oxidation will preferentially remove organic compounds useful as a food supply for the treatment ecosystem. Concentration of some less digestible compounds may be reduced by co-metabolism. Removal efficiency is limited by the minimum food concentration required to sustain the treatment ecosystem.

5.5. Chemical oxidation

Chemical (including electrochemical) oxidation is used to remove some persistent organic pollutants and concentrations remaining after biochemical oxidation. Disinfection by chemical oxidation kills bacteria and microbial pathogens by adding ozone, chlorine or hypochlorite to waste water.: 1220 Rapid sand filters

The most common type of filter is a rapid sand filter. Water moves vertically through sand which often has a layer of activated carbon or anthracite coal above the sand. The top layer removes organic compounds, which contribute to taste and odour. The space between sand particles is larger than the smallest suspended particles, so simple filtration is not enough. Most particles pass through surface layers but are trapped in pore spaces or adhere to sand particles. Effective filtration extends into the depth of the filter. This property of the filter is key

to its operation: if the top layer of sand were to block all the particles, the filter would quickly clog. Colour removal is also important if the water has to be made suitable for drinking purpose because many times underground water comes with colour and this colour has to be removed prior to drinking. Among the manufacturing operations, the textile dyeing and finishing industries are directly affecting colour; which is the most noticeable characteristic of both the raw waste and treated effluent from this industry. Although biological treatment of these waste waters is usually effective in removing a large portion of oxidize bleater, but it is frequently ineffective in removing colour. The present method for colour removal uses a green colour basic dye, an anion exchange resin called 'Duality.

To clean the filter, water is passed quickly upward through the filter, opposite the normal direction (called back flushing or backwashing) to remove embedded or unwanted particles. Prior to this step, compressed air may be blown up through the bottom of the filter to break up the compacted filter media to aid the backwashing process; this is known as air scouring. This contaminated water can be disposed of, along with the sludge from the sedimentation basin, or it can be recycled by mixing with the raw water entering the plant although this is often considered poor practice since it re-introduces an elevated concentration of bacteria into the raw water.

Some water treatment plants employ pressure filters. These work on the same principle as rapid gravity filters, differing in that the filter medium is enclosed in a steel vessel and the water is forced through it under pressure.

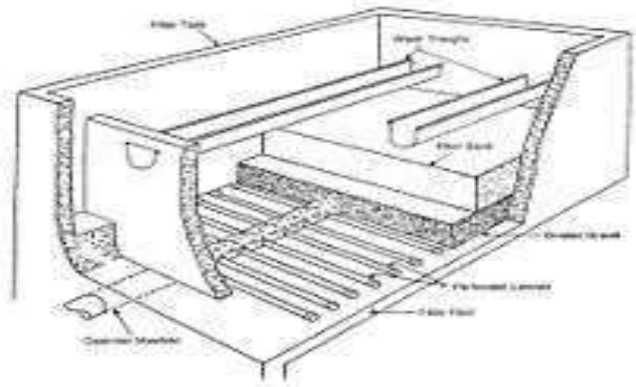

Fig -4: Pressure Filter

Advantages:

- Filters out much smaller particles than paper and sand filters can.
- Filters out virtually all particles larger than their specified pore sizes.
- They are quite thin and so liquids flow through them fairly rapidly.
- They are reasonably strong and so can withstand pressure differences across them of typically 2–5 atmospheres.
- They can be cleaned (back flushed) and reused.

5.6. Membrane filtration

Membrane filters are widely used for filtering both drinking water and sewage. For drinking water, membrane filters can remove virtually all particles larger than 0.2 μm—including giardia and cryptosporidium. Membrane filters are an effective form of tertiary treatment when it is desired to reuse the water for industry, for limited domestic purposes, or before discharging the water into a river that is used by towns further downstream. They are widely used in industry, particularly for beverage preparation (including bottled water). However no filtration can remove substances that are actually dissolved in the water such as phosphates, nitrates and heavy metal ions.

Fig -5: Filtration

Removal of ions and other dissolved substances

Ultra filtration membranes use polymer membranes with chemically formed microscopic pores that can be used to filter out dissolved substances avoiding the use of coagulants. The type of membrane media determines how much pressure is needed to drive the water through and what sizes of micro-organisms can be filtered out.[citation needed]

Ion exchange; Ion exchange systems use ion exchange resin- or zeolite-packed columns to replace unwanted ions. The most common case is water softening consisting of removal of Ca2+ and Mg2+ ions replacing them with benign (soap friendly) Na+ or K+ ions. Ion exchange resins are also used to remove toxic ions such as nitrite, lead, mercury, arsenic and many others.

Electro deionization: Water is passed between a positive electrode and a negative electrode. Ion exchange membranes allow only positive ions to migrate from the treated water toward the negative electrode and only negative ions toward the positive electrode. High purity deionised water is produced continuously, similar to ion exchange treatment. Complete removal of ions from water is possible if the right conditions are met. The water is normally pre-treated with a reverse osmosis unit to remove non-ionic organic contaminants, and with gas transfer membranes to remove carbon dioxide. A water recovery of 99% is possible if the concentrate stream is fed to the RO inlet.

6. Disinfection

Pumps used to add required amounts of chemicals to the clear water at a water purification plant before distribution. From left to right: sodium hypochlorite for disinfection, zinc orthophosphate as a corrosion inhibitor, sodium hydroxide for pH adjustment, and fluoride for tooth decay prevention.

Disinfection is accomplished both by filtering out harmful micro-organisms and by adding disinfectant chemicals. Water is disinfected to kill any pathogens which pass through the filters and to provide a residual dose of disinfectant to kill or inactivate potentially harmful micro-organisms in the storage and distribution systems. Possible pathogens include viruses, bacteria, including Salmonella, Cholera, Campylobacter and Shigella, and protozoa, including Giardia lamblia and other cryptosporidium. After the introduction of any chemical disinfecting agent, the water is usually held in temporary storage – often called a contact tank or clear well – to allow the disinfecting action to complete.

6.1. Chlorine disinfection

The most common disinfection method involves some form of chlorine or its compounds such as chloramines or chlorine dioxide. Chlorine is a strong oxidant that rapidly kills many harmful micro-organisms. Because chlorine is a toxic gas, there is a danger of a release associated with its use. This problem is avoided by the use of sodium hypochlorite, which is a relatively inexpensive solution used in household bleach that releases free chlorine when dissolved in water. Chlorine solutions can be generated on site by electrolyzing common salt solutions. A solid form, calcium hypochlorite, releases chlorine on contact with water. Handling the solid, however, requires more routine human contact through opening bags and pouring than the use of gas cylinders or bleach, which are more easily automated. The generation of liquid sodium hypochlorite is inexpensive and also safer than the use of gas or solid chlorine. Chlorine levels up to 4 milligrams per litre (4 parts per million) are considered safe in drinking water.

All forms of chlorine are widely used, despite their respective drawbacks. One drawback is that chlorine from any source reacts with natural organic compounds in the water to form potentially harmful chemical by-products. These by-products, trihalomethanes (THMs) and halo acetic acids (HAAs), are both carcinogenic in large quantities and are regulated by the United States Environmental Protection Agency (EPA) and the Drinking Water Inspectorate in the UK. The formation of THMs and halo acetic acids may be minimized by effective removal of as many organics from the water as possible prior to chlorine addition. Although chlorine is effective in killing bacteria, it has limited effectiveness against pathogenic protozoa that form cysts in water such as Guardia labia and Cryptosporidium.

6.2. Chlorine dioxide disinfection

Chlorine dioxide is a faster-acting disinfectant than elemental chlorine. It is relatively rarely used because in some circumstances it may create excessive amounts of chlorite, which is a by-product regulated to low allowable levels in the United States. Chlorine dioxide can be supplied as an aqueous solution and added to water to avoid gas handling problems; chlorine dioxide gas accumulations may spontaneously detonate.

6.3. Chloramination

The use of chloramines is becoming more common as a disinfectant. Although chloramines is not as strong an oxidant, it provides a longer-lasting residual than free chlorine because of its lower redox potential compared to free chlorine. It also does not readily form THMs or halo acetic acids (disinfection by products).

It is possible to convert chlorine to chloramines by adding ammonia to the water after adding chlorine. The chlorine and ammonia react to form chloramines. Water distribution systems disinfected with chloramines may experience nitrification, as ammonia is a nutrient for bacterial growth, with nitrates being generated as a by-product.

6.4. Ozone disinfection

Ozone is an unstable molecule which readily gives up one atom of oxygen providing a powerful oxidizing agent which is toxic to most waterborne organisms. It is a very strong, broad spectrum disinfectant that is widely used in Europe and in a few municipalities in the United States and Canada. Ozone disinfection, or ozonation, is an effective method to inactivate harmful protozoa that form cysts. It also works well against almost all other pathogens. Ozone is made by passing oxygen through ultraviolet light or a "cold" electrical discharge. To use ozone as a disinfectant, it must be created on-site and added to the water by bubble contact. Some of the advantages of ozone include the production of fewer dangerous by-products and the absence of taste and odour problems (in comparison to chlorination). No residual ozone is left in the water.[13] In the absence of a residual disinfectant in the water, chlorine or chloramines may be added throughout a distribution system to remove any potential pathogens in the distribution piping.

Ozone has been used in drinking water plants since 1906 where the first industrial coronation plant was built in Nice, France. The U.S. Food and Drug Administration has accepted ozone as being safe; and it is applied as an anti-microbiological agent for the treatment, storage, and processing of foods. However, although fewer by-products are formed by ozonation, it has been discovered that ozone reacts with bromide ions in water to produce concentrations of the suspected carcinogen bromated. Bromide can be found in fresh water supplies in sufficient concentrations to produce (after ozonation) more than 10 parts per billion (ppb) of bromated — the maximum contaminant level established by the USEPA.[14] Ozone disinfection is also energy intensive.

6.5. Ultraviolet disinfection

Ultraviolet light (UV) is very effective at inactivating cysts, in low turbidity water. UV light's disinfection effectiveness decreases as turbidity increases, a result of the absorption, scattering, and shadowing caused by the suspended solids. The main disadvantage to the use of UV radiation is that, like ozone treatment, it leaves no residual disinfectant in the water; therefore, it is sometimes necessary to add a residual disinfectant after the primary disinfection process. This is often done through the addition of chloramines, discussed above as a primary disinfectant. When used in this manner, chloramines provide an effective residual disinfectant with very few of the negative effects of chlorination.

Over 2 million people in 28 developing countries use Solar Disinfection for daily drinking water treatment.

6.6. Ionizing radiation

Like UV, ionizing radiation (X-rays, gamma rays, and electron beams) has been used to sterilize water.[citation needed]

6.7. Bromination and iodinization

Bromine and iodine can also be used as disinfectants. However, chlorine in water is over three times more effective as a disinfectant against Escherichia coli than an equivalent concentration of bromine, and over six times more effective than an equivalent concentration of iodine.[16] Iodine is commonly used for portable water purification, and bromine is common as a swimming pool disinfectant.

CONCLUSION

Water is a renewable natural resource. Due to ever increasing industrialization, urbanization, this precious resource is continuously under stress. There are multiple dimensions to water quality and its deterioration. Water pollution is rendering much of the available water unsafe for consumption. The pressure of increasing population, loss of forest cover, untreated effluent discharge from industries and municipalities, use of non-biodegradable pesticides/ fungicides/ herbicides/insecticides, use of chemical fertilizers instead of organic manures, etc are causing water pollution. Moreover, there are numerous water borne diseases like cholera, diarrhoea, dysentery etc. which are transmitted by drinking contaminated water. There are various new water purification techniques which have come up to purify water for example by using rechargeable polymer beads, using the seeds of Maringa oleifera tree, purifying water by using aerobic granular sludge technology etc. Research is being conducted all over the world to develop more and more techniques which can generate pure water at low cost. All these techniques are being developed to ensure that in near future.

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A REVIEW ON BIG DATA ANALYTIC

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ABSTRACT

Big data and business analytics are trends that are positively impacting the business world. Past researches show that data generated in the modern world is huge and growing exponentially. These include structured and unstructured data that flood organizations daily. Unstructured data constitute the majority of the world's digital data and these include text files, web, and social media posts, emails, images, audio, movies, etc. The unstructured data cannot be managed in the traditional relational database management system (RDBMS). Therefore, data proliferation requires a rethinking of techniques for capturing, storing, and processing the data. This is the role big data has come to play. This paper, therefore, is aimed at increasing the attention of organizations and researchers to various applications and benefits of big data technology. The paper reviews and discusses the recent trends, opportunities and pitfalls of big data and how it has enabled organizations to create successful business strategies and remain competitive, based on available literature. Furthermore, the review presents the various applications of big data and business analytics, data sources generated in these applications and their key characteristics. Finally, the review not only outlines the challenges for successful implementation of big data projects but also highlights the current open research directions of big data analytics that require further consideration. The reviewed areas of big data suggest that good management and manipulation of the large data sets using the techniques and tools of big data can deliver actionable insights that create business values.

Keywords: *big data; business analytics; business intelligence; Hadoop ecosystem; big data tools; review and business value*

1. INTRODUCTION

Big data analytics helps businesses and organizations make better decisions by revealing information that would have otherwise been hidden. Meaningful insights about the trends, correlations and patterns that exist within big data can be difficult to extract without vast computing power. But the techniques and technologies used in big data analytics make it possible to learn more from large data sets. This includes data of any source, size and structure. The predictive models and statistical algorithms of data visualization with big data are more advanced than basic business intelligence queries. Answers are nearly instant compared to traditional business intelligence methods.

Big data is only getting bigger with the growth of artificial intelligence, social media and the Internet of Things with a myriad of sensors and devices. Data is measured in the "3Vs" of variety, volume and velocity. There's more of it than ever before — often in real time. This torrential flood of data is meaningless and unusable if it can't be interrogated. But the big data analytics model uses machine learning to examine text, statistics and language to find previously unknowable insights. All data sources can be mined for predictions and value.

2. DEFINITION &CHARACTERISTIC OF BIG DATA ANALYTICS

2.1 Definition :

Big Data analytics is a process used to extract meaningful insights, such as hidden patterns, unknown correlations, market trends, and customer preferences. Big Data analytics provides various advantages—it can be used for better decision making, preventing fraudulent activities, among other things

2.2 Types of Big-Data :

Big Data is generally categorized into three different varieties. They are as shown below:

- Structured Data
- Semi-Structured Data
- Unstructured Data

- **Structured Data** owns a dedicated data model, It also has a well-defined structure, it follows a consistent order and it is designed in such a way that it can be **easily accessed** and used a person or a computer. Structured data is usually stored in well-defined columns and also Databases.

Example: Database Management Systems (DBMS).

- **Semi-Structured Data** can be considered as another form of Structured Data. It inherits a few properties of Structured Data, but the major part of this kind of data fails to have a definite structure and also, it does not obey the formal structure of data models such as an RDBMS.

Example: Comma Separated Values (**CSV**) File.

- **Unstructured Data** is completely a different type of which neither has a structure nor obeys to follow the formal structural rules of data models. It does not even have a consistent format and it found to be varying all the time. But, rarely it may have information related to data and time.

Example: Audio Files, Images etc.

2.3 Characteristics Of Big Data :

Big data can be described by the following characteristics:

- Volume
- Variety
- Velocity
- Variability

(i) Volume – The name Big Data itself is related to a size which is enormous. Size of data plays a very crucial role in determining value out of data. Also, whether a particular data can actually be considered as a Big Data or not, is dependent upon the volume of data. Hence, 'Volume' is one characteristic which needs to be considered while dealing with Big Data.

(ii) Variety – The next aspect of Big Data is its variety.

Variety refers to heterogeneous sources and the nature of data, both structured and unstructured. During earlier days, spreadsheets and databases were the only sources of data considered by most of the applications. Nowadays, data in the form of emails, photos, videos, monitoring devices, PDFs, audio, etc. are also being considered in the analysis applications. This variety of unstructured data poses certain issues for storage, mining and analyzing data.

(iii) Velocity – The term 'velocity' refers to the speed of generation of data. How fast the data is generated and processed to meet the demands, determines real potential in the data.

Big Data Velocity deals with the speed at which data flows in from sources like business processes, application logs, networks, and social media sites, sensorsdevices, etc. The flow of data is massive and continuous.

(iv) Variability – This refers to the inconsistency which can be shown by the data at times, thus hampering the process of being able to handle and manage the data effectively.

3. BENEFITS OF BIG DATA ANALYTICS :

- Businesses can utilize outside intelligence while taking decisions
- Improved customer service
- Early identification of risk to the product/services, if any
- Better operational efficiency

4. CONCLUSION :

The availability of Big Data, low-cost commodity hardware, and new information management and analytic software have produced a unique moment in the history of data analysis. The convergence of these trends means that we have the capabilities required to analyze astonishing data sets quickly and cost-effectively for the first time in history. These capabilities are neither theoretical nor trivial. They represent a genuine leap forward and a clear opportunity to realize enormous gains in terms of efficiency, productivity, revenue, and profitability.The Age of Big Data is here, and these are truly revolutionary times if both business and technology professionals continue to work together and deliver on the promise.

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A REVIEW ON DIGITAL FORENSIC

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ABSTRACT

Computer forensics is a relatively new, but growing field of study. It is a growing community of professionals involved in digital forensics industry. It is a science of finding evidence from digital media like a computer, mobile phone, server, or network. Criminals are using technology to commit their offenses and create new challenges for law enforcement agents, attorneys, judges, military, and security professionals. Digital forensics has become an important instrument in identifying and solving computer-based and computer-assisted crime. Open database connectivity technology is now providing access to a wide range of database technologies, such as neural networks and pattern recognition databases which are being used to analyze shoe prints and tool marks. These new computer aided analysis allow the investigators to question the data and pose scenarios to follow possible investigation paths. Connections that often took weeks or months to come to light are revealed in a fraction of time .This paper provides a brief introduction to digital forensics.

Keyword:- *Digital forensics, Digital investigation, Future forensics lab*

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1. INTRODUCTION

Digital forensics has been in the popular mainstream for some time, and has matured into an information-technology capability that is very common among modern information security programs. The goal of digital forensics is to support the elements of troubleshooting, monitoring, recovery, and the protection of sensitive data. Moreover, in the event of a crime being committed, cyber forensics is also the approach to collecting, analysing, and archiving data as evidence in a court of law. Digital forensics can be challenging when being applied to non-traditional environments, which are not, comprised of current information technologies or are designed with technologies that do not provide adequate data storage or audit capabilities. In addition, further complexity is introduced if the environments are designed using proprietary solutions and protocols, thus limiting the ease of which modern forensic methods can be utilized.

Types of investigation and incidents:-

Internal: no search warrant or subpoena needed quickest investigation. Corporate investigation that involves IT administrator reviewing documents that they should not be viewed.

Civil: other side may own the data, may need subpoena. One party sues another over ownership of intellectual property, must acquire and authenticate digital evidence so it can be submitted in court.

Criminal: highest stakes, accuracy and documentation must be of highest quality, slowest moving. Child porn investigation that involves possession and distribution of contraband.

Many a youngster today enjoy watching programmers like Cold Files and Detectives on Discovery channel, finding out how much easier it is to collect evidence about a crime today. Today, police officers and intelligence agents are utilising the expertise of forensic scientists with the latest investigative techniques to provide invaluable evidence of a crime.

To support this initiative, a range of interactive facilities are available, including surveys, forums and posting areas for information and papers. As with all user groups and communities, its success ultimately depends upon its members. Greater involvement by larger numbers will always create a more vibrant and useful experience.

2. THE REALM OF DIGITAL FORENSICS:

Digital forensics answers questions about computer events and files. Corporate investigators want to know who broke into a critical server and what websites an employee visited. Military and intelligence analysts want to examine documents and e-mails in a seized computer. Law enforcement officers seek perpetrators of both physical and digital crimes. The process is similar to investigating a physical crime scene, except that it requires specialized tools to work on digital evidence. • First the digital crime scene is preserved by making a copy of the data storage device. • The data is then searched to find clues and evidence and to unravel events from emails, disk access logs, and hidden and deleted files.

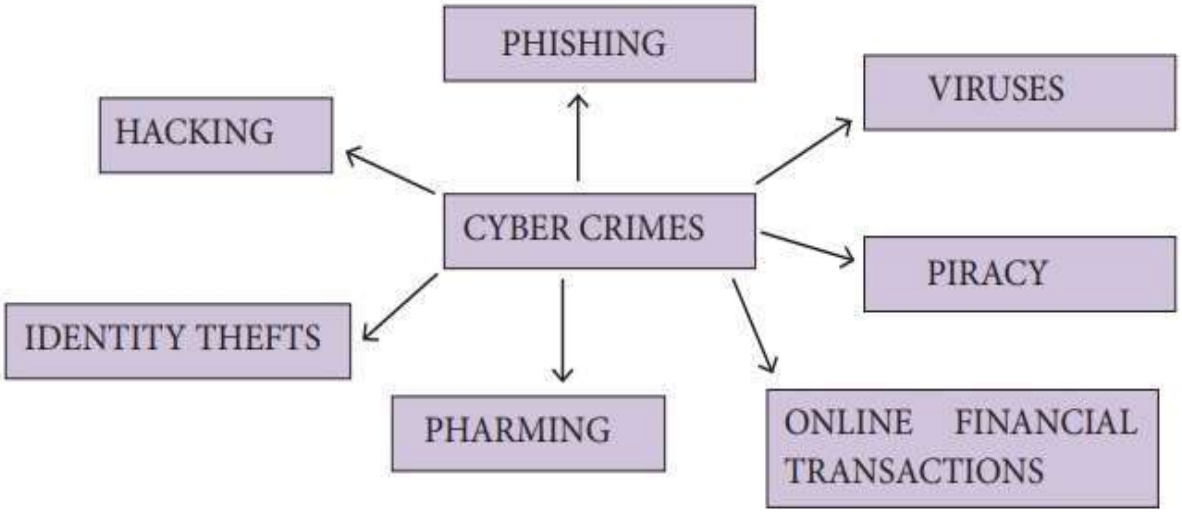

Fig-1: Types of digital crimes

2.1 CRIME AGAINST INDIVIDUALS:

Cybercrimes committed against individual persons include such types of crimes like transmission of Child Pornography, Harassment of any one with the use of a computer such as e-mail, Cyber Defamation, Hacking, Indecent exposure, E-mail spoofing, IRC Crime (Internet Relay Chat), Net Extortion, Malicious code, Trafficking, Distribution, Posting, Phishing, Credit Card Fraud and Dissemination of obscene material including Software Piracy. The potential harm of such a crime to individual person can hardly be bigger.

2.2 CRIME AGAINST PROPERTY:

Another classification of Cyber-crimes is that, Cybercrimes against all forms of property. These crimes include computer vandalism (obliteration of others' property), Intellectual Property Crimes, Threatening, Salami Attacks. This kind of crime is normally prevalent in the financial institutions or for the purpose of committing financial crimes. An important feature of this type of offence is that the amendment is so small that it would normally go unobserved.

2.3 CRIME AGAINST ORGANIZATION:

The third type of Cyber-crimes classification relate to Cybercrimes against organization. Cyber Terrorism is one discrete kind of crime in this kind. The growth of internet has shown that the standard of Cyberspace is being used by individuals and groups to pressure the international governments as also to terrorize the citizens

of a country. This crime obvious itself into terrorism when a human being "cracks" into a government or military maintained.

3. DIGITAL FORENSICS (THE NEXT GENERATION OF DIGITAL INVESTIGATION TOOLS)

A forensic investigation can be initiated for a variety of reasons. The most high profile are usually with respect to criminal investigation, or civil litigation, but digital forensic techniques can be of value in a wide variety of situations, including perhaps, simply re-tracking steps taken when data has been lost. Digital investigations and crime regularly cross international and language borders today. Companies like Basis Technology's next-generation Odyssey Digital Forensics™ products dissolve linguistic boundaries enabling analysts to search multilingually as easily as in English. The Computer Forensics Toolkit was created by eminent practitioners, with many years experience in the industry. The items included have been tried and tested in the field countless times, and are in everyday use.

Odyssey cuts through technical complexities that digital investigators increasingly encounter: How to capture data from computers that may not be brought into the lab? How to search through data in languages the investigator doesn't know? How to take full advantage of the array of available digital forensics tools, each with its own proprietary file formats?

a) **Capture**: the Media Exploitation Kit enables experts and non-experts alike to capture data off hard disks, while also documenting the integrity and source of the data.
b) **Analysis**: Odyssey Digital Forensics Keyword Searching System's smart search crosses language and file format "barriers." Analysts need not know all the languages of the data to perform searches that quickly bring significant files to the fore.
c) **Portability**: the Advanced Forensic Format (AFF) for storing captured data is open and extensible to make that data available for analysis by any tool the investigator chooses.

Fig-2: Process of digital forensics

4. THE FUTURE FORENSIC LAB:

Several social and technological trends are converging that will profoundly change the forensic laboratory. Already, computer crimes are opening up a new area of criminal investigation that is becoming incorporated into lab methodology. The new breed of forensic computer experts will fall under the heading of behavioural specialists and will work closely with forensic psychologists in pursuit of the computer criminal. It is expected that the microscope will be partly replaced in the future with three-dimensional laser scanning equipment, such as a laser profilometry system. Currently, laser profilometry is slow and there are artefacts in the scanning. But these problems will be resolvedand the equipment will become faster and more accurate.

Computerizing criminal investigations has been the result of departments investing in records management systems. These help the department process and track every bit of information captured by the Computer Aided Dispatching system and by the agency's officers. The information is fed into the records management system and manipulated to help administrators do case management, analyze beats, track budgets, assign personnel, inventory the property and evidence room, and write statistical reports.

Image processing systems are another facet of computer technology. Documents, photos, fingerprints, or crime scene photographs are scanned, digitized, and stored in the department's database. Photographs of suspects and crime scenes can also be taken with a digital camera. The picture is transferred to a color monitor, where it appears as an electronic image. When the operator gets the best picture possible on the screen, the computer freezes the image, digitizes and stores it. That information is then filed in a case file, an individual's criminal history file, or in the department's records management system. Open database connectivity technology is now providing access to a wide range of database technologies, such as neural networks and pattern recognition databases, which are being used to analyze shoe prints and tool marks. Soon, data-mining tools will have a significant impact. These new computer-aided analysis tools can link and chart case information, allowing the investigator to question the data and pose scenarios as well as suggest and follow possible investigative paths.

As a result, connections that often took weeks or months to come to light are revealed in a fraction of the time. Unlike some industries, there is no overseeing organization to determine how testing gets done or even if they need to use a LIMS. The American Society of Crime Laboratory Directors (ASCLD) suggests ways of doing business in a crime lab, mainly covering general procedures. ASCLD will inspect the lab, documentation, and procedures to ensure consistency and conformity to its standards. The lab can then be classified as ASCLD-certified, which is becoming increasingly important. Using a laboratory information management system (LIMS) greatly simplifies information handling and documentation. Because a LIMS can track large amounts of evidence and case-related information across various sections of the laboratory, and even across networked laboratory systems that span large geographical areas, it is ideal for forensic laboratories. In addition, because a LIMS uses bar coding and password security, when the integrity of an evidence trail is challenged in court, the records maintained by the LIMS can show who handled the evidence, how and when it was transferred to another person or location, and who examined it.

CONCLUSION

The forensic examination of electronic systems has undoubtedly been a huge success in the identification of cyber and computer-assisted crime. Organizations are placing an increasing importance on the need to be equipped with appropriate incident management capabilities to handle misuse of systems. Computer forensics is an invaluable tool in the process. The domain of computer forensics has grown considerably in the last decade. Driven by industry, focus was initially placed upon developing tools and techniques to assist in the practical application of the technology. In more recent years, an increasing volume of academic research is being produced exploring various new approaches to obtaining forensic evidence.

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Internet of Things: a review

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ABSTRACT

Internet of Things (IoT) is a technology which connects billion of devices with the help of internet. All the devices in the network are interacted with each other to collect and share data. System of interacted devices where each and every device have unique identity and can transfer data over network. Today IoT is being used extensively to lessen the burden on humans it provides advance services to the society and business. Smart city, smart home, smart car, smart malls are some of the areas with IoT based technology. Lots of research has been done and it is estimated that in future 20-50 billion devices are going to be internetworked. There are many benefits of IoT such as efficient resource utilization, time saving, reduces effort and error, security, also it is user friendly. Still there are many challenges as we have internet of thing that is not a single technology. Physical devices can of different configuration and different specification. This article discusses the basic of IoT, component architecture, application, issues with IoT. This would help readers and researchers to understand the IoT in better way.

Keyword: - *Internet of Things, Unique identifiers, Sensors, and Internetworked*

1. Introduction

The internet of things or IoT refers to the billions of physical devices around the world that are now connected to the internet. The IoT brings the power of internet, data processing and analytics to the real world of physical objects. For consumers, this means interacting with the global information network without the intermediary of keyboard and screen, many of their everyday objects and appliances can take Instructions form that network with minimal human intervention.

The connection of IoT things and usage of IoT data enables various improvements and innovations in the lives of consumers in business, healthcare, mobility, cities and society. The Internet of Things is the logical next step in the evolution of the internet and is a continuation of M2M (machine-to-machine) network and technology, building upon and extending technologies, building upon and extending technologies, RFID and more. The internet of things converges industries and business areas, uniting information technology and operational technology. The main areas of internet of things are manufacturing operations, transportation, smart grid technology, smart buildings and smart home automation and retail

Eg1: Light bulb that can be switched on using a smart phone.,
Eg2: Driver less car

Why IoT is so important

The Internet of Things helps people live and work smarter, as well as gain complete control over their lives IoT enables industries to automate processes and reduce labor costs it also cut down the waste and improves service delivery. It is less expensive and offers transparency into the customer transaction

As such, IoT is one of the most important technologies of everyday life, and it will continue to pick up stream as more businesses realize the pot4ential of connected devices to keep them competitive.

History of IoT

Kevin Ashton coined the phrase 'Internet of Things' in 1999

The idea of adding sensors and intelligence to basic objects was introduced during 1980s and 1990s. But only few projects such as internet-connected vending machine were developed. The Chips were too big and bulky and there was no way for objects to communicate effectively.
After the invention of low-power chips that can communicate wirelessly, along with the increasing availability of broadband internet, and cellular and wireless networking, was the problem solved. The adoption of IPv6, amongother things, provides enough IP addresses for every device the world is ever likely to need was also a necessary step for the IoT.

2. How IoT works

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to and IoT gateway or other edge devices where data is either sent to the cloud to be analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices for instance to set them up give them instructions or access the data.
The connectivity, networking, and communication protocols largely depend on the specific IoT application.
IoT can also make use of artificial intelligence and machine learning to aid in making data collecting process easier and more dynamic

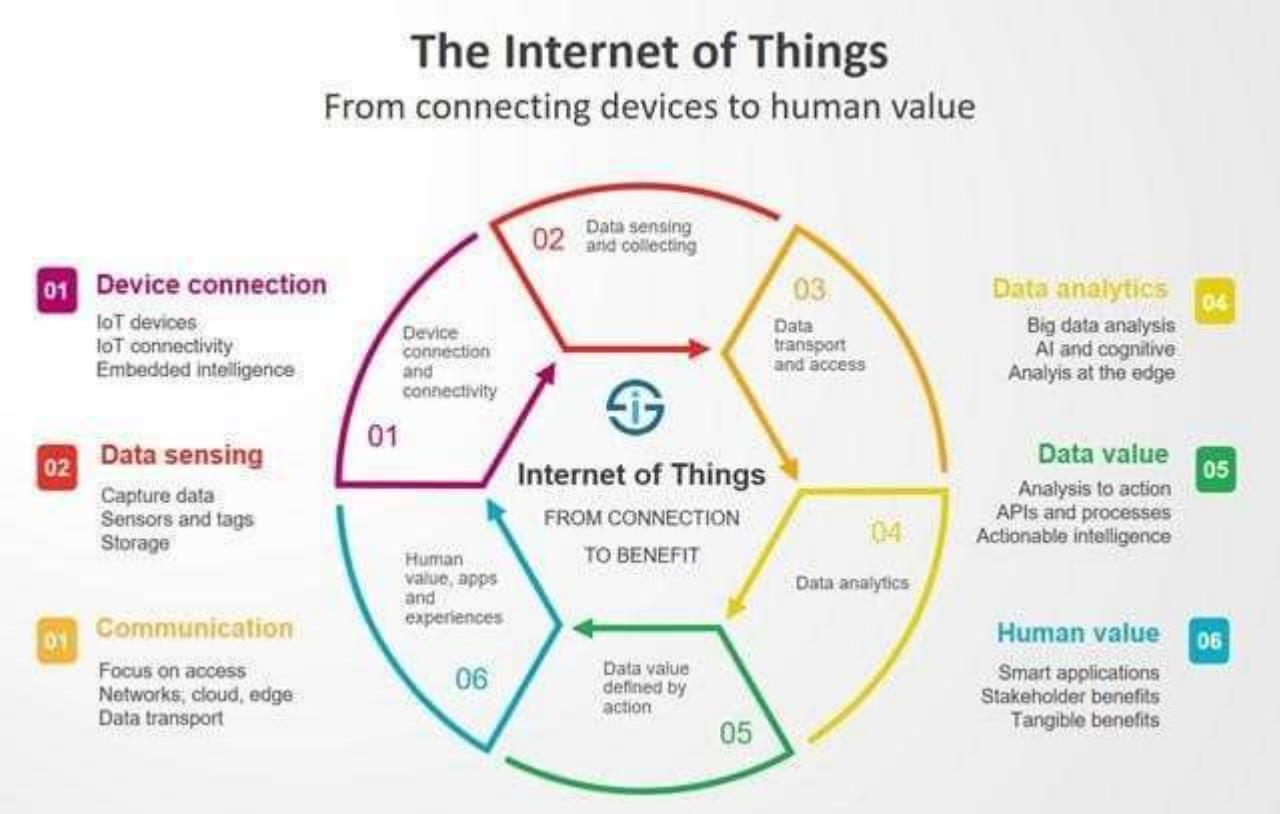

Fig -1: Internet of Things: how it works

IoT Components

We have 4 fundamental components of IoT system, which tells us how IoT works.

Sensors/Devices

Sensors help in collecting very minute data from the surrounding environment. A device can have multiple sensors that can bundle together to do more than just sense things. For example, our phone is a device that has multiple sensors such as GPS, accelerometer, camera but our phone does not simply sense things.

Connectivity

The collected data from sensor is sent to a cloud infrastructure but it needs a medium for transport**.**
The sensors can be connected to the cloud through various mediums of communication and transports such as cellular networks, satellite networks, Wi-Fi, Bluetooth, wide-area networks (WAN), low power wide area network and many more.
Every option we choose has some specifications and trade-offs between power consumption, range, and bandwidth. So, choosing the best connectivity option in the IOT system is important.

Data Processing

Once the data is collected and it gets to the cloud, the software performs processing on the acquired data.
This can range from something very simple, such as checking that the temperature reading on devices such as AC or heaters is within an acceptable range. It can sometimes also be very complex, such as identifying objects (such as intruders in your house) using computer vision on video. But there might be a situation when a user interaction is required, example- what if when the temperature is too high or if there *is* an intruder in your house? That's where the user comes into the picture.

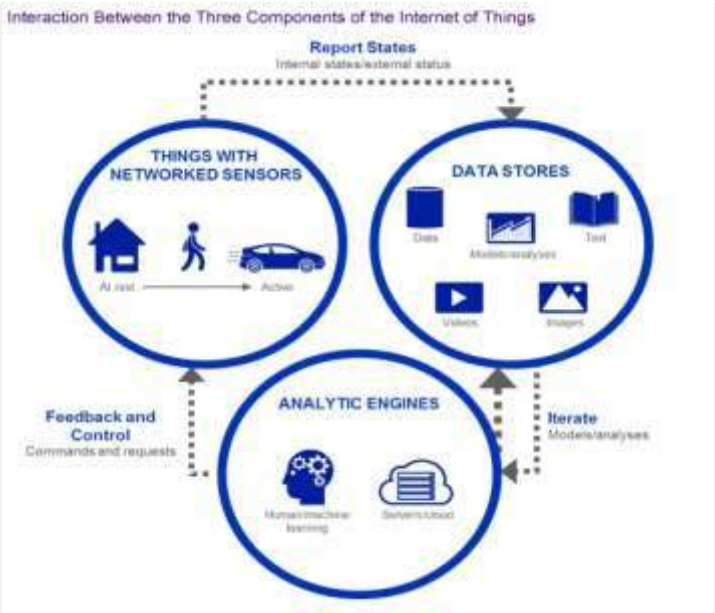

Fig -2: Components of IoT: Data Processing

User Interface

Next, the information made available to the end-user in some way. This can achieve by triggering alarms on their phones or notifying through texts or emails.
Also, a user sometimes might also have an interface through which they can actively check in on their IOT system. For example, a user has a camera installed in his house, he might want to check the video recordings and all the feeds through a web server.

3. IoT Hardware and software

IoT Hardware includes a wide range of devices such as devices for routing, bridges, sensors etc. These IoT devices manage key tasks and functions such as system activation, security, action specifications, communication, and detection of support-specific goals and actions.
The software and the programming languages on which IoT works uses very common programming languages that programmers use and already know.

IoT Hardware

The hardware utilized in IoT systems includes devices for a remote dashboard, devices for control, servers, a routingor bridge device, and sensors. These devices manage key tasks and functions such as system activation, action specifications, security, communication, and detection to support-specific goals and actions.

Hardware used in IoT:

ARDUINO UNO: it is a single-board processor that are plugged into main boards to improve and increase its functionality by bringing out specific functions

RASPBERRY Pi 2: Often called "RasPi," exhibits great processing capabilities, especially when usingthe Python programming language**.**

BEAGLE BOARD: a single-board computer with a Linux-based OS that uses an ARM processor

Arduino uno **Raspberry Pi2** **Beagle borard**

Fig -3: **IOT Hardware**

IoT software

The most commonly used operating systems are Linux or UNIX-like OSs like Ubuntu Core or Android.
IoT software encompasses a wide range of software and programming languages from general-purpose languages like C, C++, Java, python

4. CONCLUSIONS

In a world dominated by digital technology, the IoT plays a prominent role in our lives. It has created an ecosystem that links many systems to give smart performances in every task. The proliferation of the IoT has created a new evolution of cell phones, home and other embedded applications that are all connected to the internet. They have impeccably integrated human communication in ways we never expected before

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A Review Paper of Experimental Investigation of Abrasive Water Jet Machining

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ABSTRACT

The objective of this study is to present the optimal machining parameters for abrasive water jet machining (AWJM) of Aluminum alloy 5083 (AA5083) by employing Taguchi method for various material thicknesses. Al 5083 alloy finds vast applications in ship building, rail cars, and vehicle bodies and exclusively for cryogenic applications. The experimental work was carried out by using Taguchi L18 orthogonal array to study the influence of the process parameters such as jet diameter, stand-off distance and abrasive flow rate for various ranges of thicknesses over the process yields namely material removal rate (MRR), surface roughness and taper error. Technological table for optimal machining of AA5083 alloy in AWJM was reported for ready to use in industry.

Keyword : *abrasive water jet machining; AWJM; aluminum alloy; Taguchi method; technology table.*

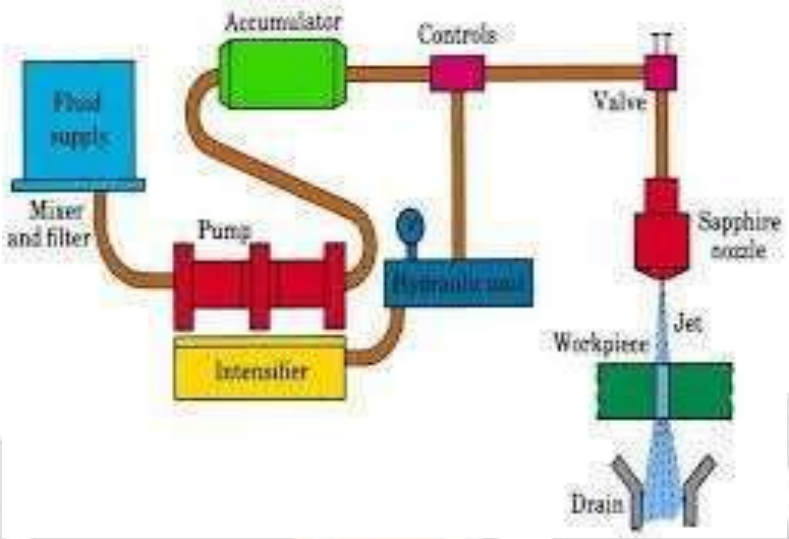
1. BIOGRAPHICAL NOTES:

Gurusamy Selvakumar is currently an Associate Professor in the Department of Mechanical Engineering, SSN College of Engineering, Chennai, India. He has published 19 international journal papers, 2 national journal papers, 12 conference papers, edited 3 books and published 1 book in 2 G. Selva kumar et al. the area of advanced manufacturing processes. One research project sponsored by SERB for a tune of 32 Lakh (INR) is in progress. Presently 11 PhD scholars of Anna University, Chennai, they are pursuing PhD under his supervision and five ME theses have been completed under his guidance.
Shanmuga Sundaram Ram Prakash obtained his BE (Mechanical Engineering) and ME (Manufacturing Engg.) from the National Engineering College, Kovilpatti (Anna University, Chennai) in 2013 and 2015 respectively. He is presently working in SSN College of Engineering as a Junior Research Fellow in a SERB sponsored research project titled 'Investigations on Wire Electrical Discharge Machining (WEDM) of Low Conductive Materials'. He has presented two papers in international conferences and published one international journal paper. His area of interest includes non-traditional machining processes and composite materials.

Nagarajan Lenin is an Associate Professor in Department of Mechanical Engineering, Veltech Dr. RR & Dr. SR University, Chennai, India. He published ten international journal papers, six conference papers and one edited book in the area of facility layout design. He is currently guiding one full time PhD scholar in the field of industrial automation.

Water Jet Machining (WJM) and Abrasive Water Jet Machining (AWJM) are two non-traditional or non-conventional machining processes. They belong to mechanical group of non-conventional processes like Ultrasonic Machining (USM) and Abrasive Jet Machining (AJM). In these processes (WJM and AJWM), the mechanical energy of water and abrasive phases are used to achieve material removal or machining. the basic methodology remains the same. Water is pumped at a sufficiently high pressure, 200-400 MPa (2000- 4000 bar) using intensifier technology. An intensifier works on the simple principle of pressure amplification using hydraulic cylinders of different crosssections as used in "Jute Bell Presses". When water at such pressure is issued through a suitable orifice (generally of 0.2- 0.4 mm dia), the potential energy of water is converted into kinetic energy, yielding a high velocity jet (1000 m/s). Such high velocity water jet can machine thin sheets/foils of aluminium, leather, textile, frozen food etc. In pure WJM, commercially pure water (tap water) is used for machining purpose. However as the high velocity water jet is discharged from the orifice, the jet tends to entrain atmospheric air and flares out decreasing its cutting ability. Hence, quite often stabilizers (long chain polymers) that hinder the fragmentation of water jet are added to the water. In AWJM, abrasive particles like sand (SiO2), glass beads are added to the water jet

to enhance its cutting ability by many folds. AWJ are mainly of two types – entrained and suspended type as mentioned earlier. In entrained type AWJM, the abrasive particles are allowed to entrain in water jet to form abrasive water jet with significant velocity of 800 m/s. Such high velocity abrasive jet can machine almost any material. Fig. 1 shows the photographic view of a commercial CNC water jet machining system along with close-up view of the cutting head.



2. EXPERIMENTAL SET-UP:

The experiment device of ultrasonic vibration assisted abrasive water jet, as Figure 1 shows, is composed of the ultrasonic auxiliary device, the abrasive water jet system including the abrasive water jet nozzle, the movement control device, the work piece (ceramics), the collector, and so on.

Among them, the ultrasonic auxiliary device, as is shown in Figure 2(b), can provide the vibration with a frequency of 20 KHz, and the amplitude is about 20 um, the vibration amplifier is used to change vibration aptitude, and it is connected with the abrasive nozzle by stud bolts; the abrasive water jet system, as is shown in Figure 2(a), can provide the water jet with a pressure within 0–70Mpa, the working system pressure of water jet in this study is between 5 and 25MPa, the value is pretty low because these experiments aim to study the micro machine the ceramics, and the ultrasonic vibration also helps to decrease the working pressure. The water jet nozzle diameter is 1 mm. The stand-off is within 3–7mmand the abrasive supply rate is 2.5mg/s. The erosion surface morphology of experimental sample is observed and analyzed with the help of an instrument of 3D Laser Shape Measurement.

3. EXPERIMENTAL WORK:

The AWJM comprises of water softening unit with two cylindrical tanks, an intensifier pump, an abrasive hopper, an air compressor, abrasive water jet cutting head and fixture for holding the work piece. The cutting head with a nozzle is mounted on a stationary work table. The abrasives are fed to the mixing chamber by means of compressed air. The debris of the cut specimen is settled in the catcher tank which is partially filled with water. Based on the previous literatures and some trial runs, parameters such as jet diameter, standoff distance, material thickness and abrasive flow rate were considered for this experimentation. Control factors and their levels are shown in Table 1. Taguchi's L18 orthogonal array was used to carry out the experimentation. The experimental work has been carried out in AQUA TECH 3001.15W of Micro step group.

Table 1 Control factors and their levels

Sl. no	Coded value	Control factors	Level-I	Level-II	Level-III	unit
1	A	Jet diameter	0.76	1.2	-	mm
2	B	Standoff distance	0.5	0.7	0.9	mm
3	C	Thickness	15	35	55	mm
4	D	Abrasive flow rate	270	295	320	g/min

4. PARAMETRIC ANALYSIS BY TAGUCHI METHODOLOGY:

To yield better performance in AWJM process, the MRR should be maximum, the surface roughness (Ra) and the taper error should be minimum. Hence, higher is better for MRR, lower is better for surface roughness and taper error were chosen to achieve optimum performance in AWJM. Table 2 shows the experimental results in L 18 orthogonal array. The responses MRR, Ra and taper error along with its signal to noise (S/N) ratio (η) is shown in Table 2. The analysis of MRR data is reported in Table 3. It revealed that the material thickness plays a predominant role in determining the MRR followed by jet diameter. From Figure 2, it is observed that the MRR shows an increasing trend with the increase of jet diameter and material thickness. As the increase in jet diameter increases the volume flow rate of the jet, it exhibits the increasing trend with the MRR. The MRR is the product of the traverse speed, kerf width and the thickness of the workpiece. Hence it is obvious that the increase in thickness shows the increasing trend with the MRR as seen in Figure 2. From Figure 2 and Table 3, the optimal parameter setting for achieving higher MRR has been A2C3.

Figure 2 Factor effects on s/n ratio for MRR (see online version for colours) From Table 4, it is clearly understood that stand-off distance and material thickness are the prime factors on fixing the surface roughness. Figure 3 depicts that the surface finish decreases (i.e., Ra increases) with increase in SOD and workpiece thickness. Higher SOD

makes the jet plume expand thus it reduces the particle density at the boundary of the jet. 6 G. Selvakumar et al. Increase in material thickness decreases the surface quality due to bluntness of abrasive particles as it passes more distance from the surface. Hence, SOD and material thickness shows the decreasing trend with the surface finish. The optimal parameter setting for achieving better surface quality is B1C1.4.

Table 2 Experimental data with S/N ratio

Experiment no.	A	B	C	D	mrr (g/min)	Ra (μm)	Taper error (radian)	η(dB)		
								mrr	Ra	Taper error
1	1	1	1	1	0.2525	1.46	0.4886	–11.955	–3.2870	6.2209
2	1	1	2	2	0.3527	1.54	0.6956	–9.0509	–3.7504	3.1528
3	1	1	3	3	0.8198	1.48	0.9562	–1.7260	–3.4052	0.3890
4	1	2	1	1	0.3232	1.40	0.5882	–9.8103	–2.9225	4.6095
5	1	2	2	2	0.5749	1.98	0.7652	–4.8089	–5.9333	2.3245
6	1	2	3	3	0.9942	1.60	0.8576	–0.0503	–4.0824	1.3343
7	1	3	1	2	0.2381	1.41	0.7579	–12.464	–2.9843	2.4077
8	1	3	2	3	0.3034	1.67	0.9543	–10.359	–4.4543	0.4063
9	1	3	3	1	0.5515	3.02	1.9854	–5.1694	–9.6001	–5.9569
10	2	1	1	3	0.7689	1.40	0.4892	–2.2826	–2.9225	6.2102
11	2	1	2	1	0.7641	1.53	1.4163	–2.3370	–3.6983	–3.0231
12	2	1	3	2	1.2640	1.76	1.6245	2.0352	–4.9102	–4.2143
13	2	2	1	2	0.1507	1.61	0.5865	–16.439	–4.1365	4.6346
14	2	2	2	3	0.8532	2.05	1.5972	–1.3789	–6.2350	–4.0671
15	2	2	3	1	0.9591	1.95	1.6163	–0.3622	–5.8006	–4.1704
16	2	3	1	3	0.8699	1.52	0.7198	–1.2102	–3.6368	2.8557
17	2	3	2	1	0.9894	3.05	0.8845	–0.0922	–9.686	1.0660
18	2	3	3	2	1.2503	2.80	1.2045	1.9401	–8.9431	–1.6161

Table 3 Analysis of mrr data

ANOVA for mrr (95 % confidence level)						η value for mrr		
Control factor	DF	SS	MS	% contribution	F	Mean η by factor level(dB)		
						Level 1	Level 2	Level 3
A	1	113.85	113.85	21.78	7.67	–7.2662	–2.2364	-
B	2	5.06	2.53	0.96	0.17	–4.2195	–5.4751	–4.5593
C	2	215.37	107.68	41.21	7.25	–9.0272	–4.6713	–0.5554
D	2	39.91	19.95	7.63	1.34	–4.9545	–6.4648	–2.8346
Error	10	148.44				Overall mean = –4.7513		
Total	17	522.61				Optimal combination: A2C3		

Note: DF – degrees of freedom; SS – SUM OF SQUARES; MS – mean square.

Figure 3 Factor effects on S/N ratio for Ra (see online version for colours)

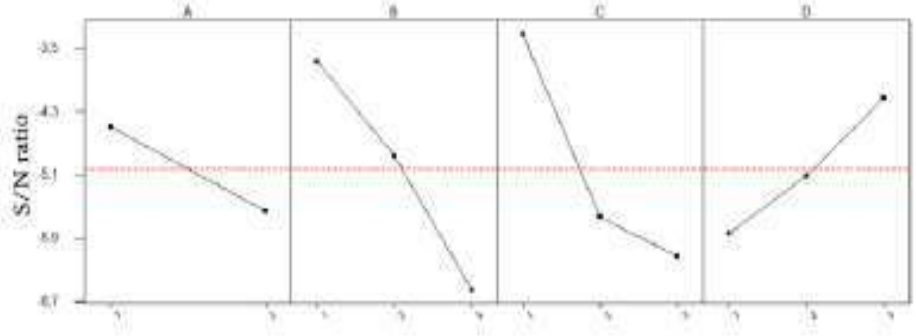


Figure 4 Factor effects on S/N ratio for taper error (see online version for colours)

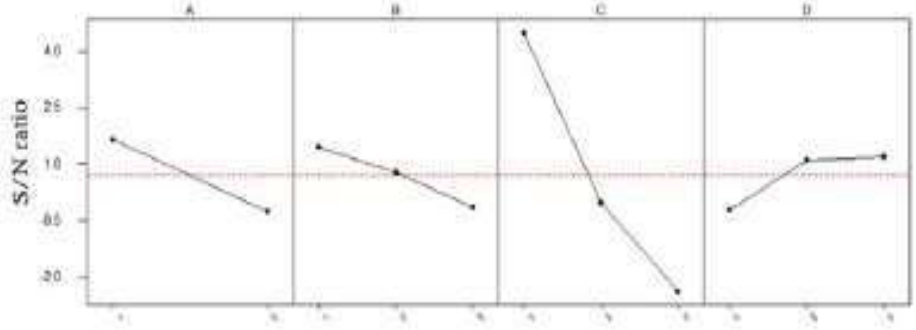


Table 4 Analysis of Ra data

ANOVA for Ra (95 % confidence level)						*η value for Ra*		
Control factor	*DF*	*SS*	*MS*	*% contribution*	*F*	*Mean η by factor level(dB)*		
						Level 1	*Level 2*	*Level 3*
A	1	5.062	5.062	5.826427	2.44	–4.4910	–5.5516	-
B	2	25.302	12.651	29.12293	6.1	–3.6615	–4.8517	–6.5508
C	2	26.95	13.475	31.0198	6.5	–3.3149	–5.6245	–6.1236
D	2	8.832	4.416	10.16575	2.13	–5.8317	–5.1096	–4.1227
Error	10	20.742				Overall mean = –5.0213		
Total	17	86.888				Optimal combination: B1C1		

5. CONCLUSIONS:

The experimental study on abrasive water jet machining (AWJM) of AA5083 is reported. The influence of process parameters on MRR, Ra and taper error were reported by adopting Taguchi methodology. Based on the experimental data, ANN prediction was performed. Based on the thickness of the job, the ANN predictions were grouped and Pareto optimization technique was applied to achieve optimal machining conditions. Technology tables for various thicknesses were reported for optimal processing of AA5083 in AWJM. The reported handy technology table can be easily used even by a semi-skilled or unskilled worker.

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AN EXPERIMENTAL STUDY ON VARIOUS STAGES OF PERFORMANCE IN SOFTWARE TESTING PROCESS

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ABSTRACT

In this chapter we introduce different Process to tackle these issues, taking into account agent's properties. Especially, we investigate automated ways to generating test inputs that can produce enormous number of different and challenging situations to exercise the agents under test. This overcomes the limited human effort for testing. The automated generation, to some extent, helps dealing with the dynamic nature of the environments where the agents under test operate.

Keywords: *Error, Techniques, SE, Analysis, SDLC*

1. Introduction

In this chapter, we first present three perspectives to evaluate behaviors of software agents. As agents are autonomous, saying if an agent exhibits a correct behavior or not is not as straightforward as traditional programs. We put test evaluation, i.e. to evaluate test results, in the first place as feedbacks from test results give important insights to guide the automated test input generation. Then, we introduce monitoring as a way to collect data about test execution. The monitoring technique can deal with the distributed and asynchronous property of agent-based systems, and provide a global view of what happens during test execution. Finally, we present four test generation and one novel execution techniques.

1.1 Monitoring

In testing software agent and MAS, monitoring plays an important role as it allows us to observe the operation and interaction of the agents under Test. It provides necessary data to detect abnormalities in the system, such as constraint violation, communication semantics mismatching, or requirement unsatisfaction. We propose two reference architectures for monitoring agent locally, Figure 1.1, and globally, Figure 1.2.

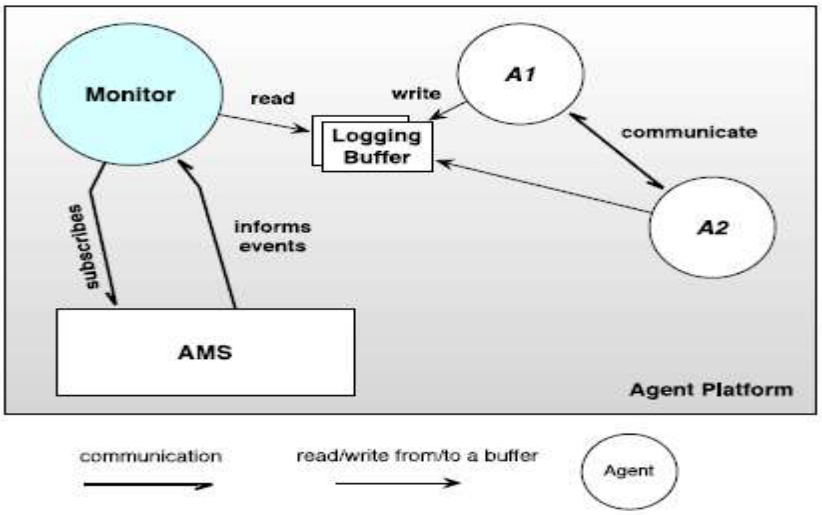

Figure 1.1: Reference architecture for monitoring one single platform

At the local level, in a single platform shown in Figure 1.2, a special agent named *Monitor* (or *Monitoring Agent* in other places) subscribes itself to the Agent Management System (AMS)3 (FIPA 2004) in order to be notified about all relevant events happen within the platform. These events include: an agent was born, is dead, is frozen, moves, adopts a goal, changes its beliefs, and the like. In particular, the AMS will inform the *Monitor* about any interactions, messages sent or received by the agents under test.

The AMS is responsible for managing the operation of an agent platform, such as the creation of agents, the deletion of agents, deciding whether an agent can dynamically register with the agent platform and overseeing the migration of agents to and from the platform. Registration with the AMS implies authorization to access the message transport service of the agent platform.

In addition, we propose to use a special component called *Logging buffer.* As the name says, this is a buffer where observed data can be store and read. Information about violations, exceptions or desired data to be ob served, such as states of the agent under test, are stored into this buffer. The monitoring agent is in charge of watching this buffer to report any problem occurred. Agent code can be instrumented; aspect programming can be used to inject code for monitoring. In particular cases when al lowed, we can ignore the logging buffer. Instead, monitoring code can send messages about problem to the monitoring agent, transparently with the agents under test.

At the global level, since a MAS usually consists of multiple distributed platforms, Figure 4.5, it is important to incorporate information from all of them to provide a complete and full view about the system under test. This can be achieved by means of a network of monitoring agents: the remote monitoring agents act the same as the *Monitor* at the local level, mentioned above, each is responsible for monitoring one single platform; all observed data from the distributed platforms are sent to the Central Monitoring Agent. Therefore, we obtain a global and synthesized view of the system during test execution.

One possible issue that needs attention is possible side effects of using the monitoring agents. That is, the monitoring agents might influence the behaviors or the performance of the agents under test. The monitoring agents need to be implemented or deployed in a way that is as much trans parent to the agents under test as possible. Or at least, we need to control the testing environment to dismiss any side-effect problem.

These architectures are implemented in our tool, Real-time observed data help not only detecting problems, but also providing useful feedbacks to guide automated test input generation. The next section will discuss test generation techniques.

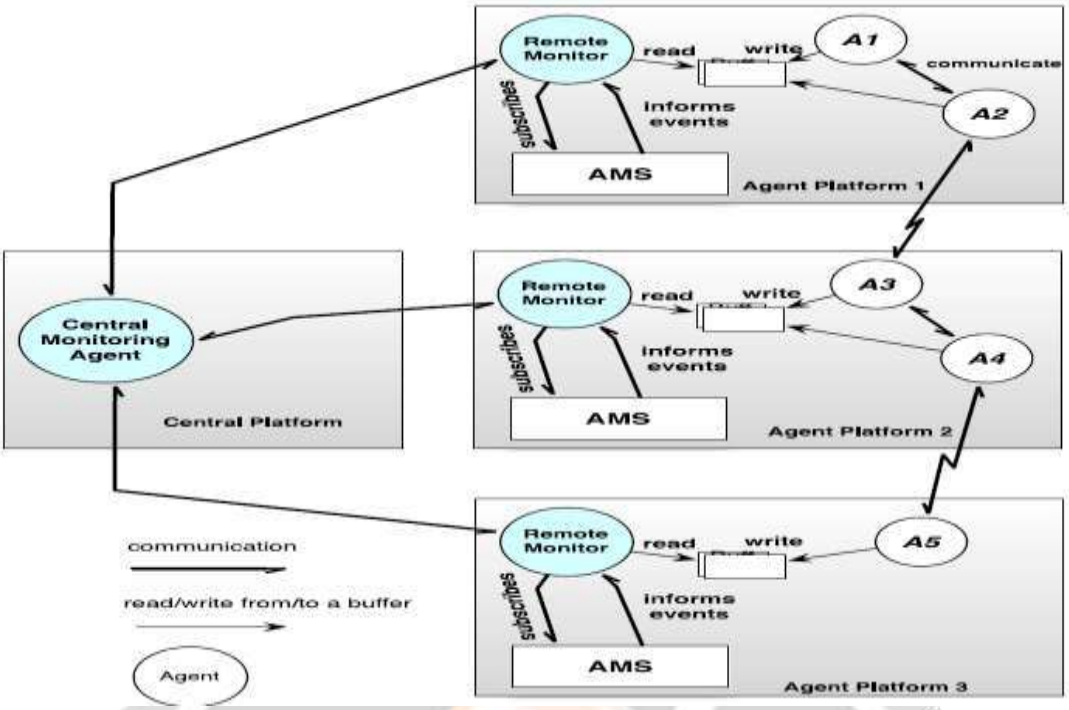

Figure 1.2: Reference architecture for monitoring multiple platforms

1.2 Generation

1.2.1 Test inputs for software agents

Georgeff and Ingrand (1989) presented a minimal design of reference architecture for BDI agents (Rao and Georgeff 1995), which has been being widely applied to build autonomous agents. In the architecture, agents perceive the outside world (environment) through a set of sensors and make changes to the world through a set of effectors. Recently, Weyns et al. (2007) complemented to that architecture with a reference model for the environment, in which agents access the environment by employing perception (sense and percept), action (make changes to the environment), or communication (send and receive messages).

In terms of test inputs, from the proposed architectures we identify two types of black-box test input for agents: environmental settings and incoming messages. The former type concerns the surrounding world with respect to an agent; changes that are perceived by the agent can lead it to expose different behaviors. For instance, if an obstacle appears on the path that an agent is following, the agent might change its path instead of going straight or try to remove the obstacle. The latter concerns the messages that are sent to agents under test. These messages, once accepted by the agents, may ask the agents to fulfill a task or to reach a goal. More generally, incoming messages can change the behavior of agents.

Depending on the kind of the agents under test, test inputs can be generated by producing environmental settings upon which the agents under test operate, or by creating messages and submitting them to the agents, or both.

1.2.1 Goal-oriented generation

Goal-oriented test cases generation is a part of a methodology, presented in Chapter 3. It integrates testing into Tropos, providing a systematic way of deriving test cases from Tropos output artefacts. Goal-based specification diagrams are used as inputs to generate test case skeletons to test goal fulfillment. Specific test inputs (i.e. message content), and expected outcome are partially generated from plan design (e.g., UML activity or sequence diagrams) and are then completed manually by the tester according to some test scenarios. These scenarios can be user-defined, or can follow some particular interaction protocols.

1.2.3 Ontology-based generation

This technique concerns generating messages to test software agents. Agent behaviors are often influenced by messages received. Hence, at the core of test case generation is the ability to build meaningful messages that exercise the agent under test so as to cover most of the possible running conditions. We propose an approach to test

generation using agent interaction ontology. The approach exploits ontology that defines the semantics of agent interactions to generate test inputs and guide the exploration of the input space. We develop an ontology-based input generator. It is integrated with our testing framework, introduced in the next chapter valid inputs. The task of the ontology-based test generator consists of completing the message content to send to the agent under test. For each concept to be instantiated in the message, the generator either picks up an existing or creates a new instance of the required concept. No input value is generated by the test generator if the interaction protocol prescribes that a value from a previously exchanged message must remain the same.

Then, the selected instance is encoded according to a proper content codec (for the message content) and is made ready to be executed. As an example, the following excerpt shows an XML-encoded content of a message that contains information about a proposal for a book, including the Propose action:

```
<root ... xmlns="jadex.examples.booktrading.ontology"/>
   <Book n:id="2" title="Introduction to MultiAgent Systems"
                  author="Michael Wooldridge"/>
   <Propose n:id="1" price="47.50" r:book="2"/>
</root>
```

When new instances are generated, the test generator selects one from those available in the ontology. The selection is based on the number of usages of each instance, or aims at increasing the diversity of test inputs and exploring the input space more extensively. In the case when no ontology instances are available, valid test inputs can be still generated by using available information, such as rules and property data types, specified in the interaction ontology. For example, based on the rule about the *price*, the generator can generate any value in the range from 0 to 2000 as a valid input value to be processed by the *Seller or Buyer* agents. More generally, for the properties of *Numeric* data type, we can exploit the boundaries of the data type, as well as the rules that limit the values of the properties, to generate valid input values. For the properties of *string* data type, we can only exploit the list of allowed values, if available. Most of the times, meaningful values for properties of string data type are hardly generated without the help of ontology. The full list of valid input generation rules is provided in Table 4.1.

Invalid input generation. Invalid input generation is based on rules and data types that appear in the interaction ontology. When boundaries are specified for numeric properties, the generator goes beyond them deliberately.

Datatype	Rule	Description
Numeric	**RVN1**	New value that has not been used before from ontology instances
	RVN2	Reused value from ontology instances
	RVN3	Randomly generated value respecting rules in ontology
	RVN4	Default or template value defined in ontology
Boolean	**RVB1**	*true*
	RVB2	*false*
String	**RVS1**	New value that has not been used before from ontology instances
	RVS2	Reused value from ontology instances
	RVS3	Randomly generated value respecting rules in ontology
	RVS4	Default or template value defined in ontology

Table 1.1: Valid input generation rules

For string properties, the generator produces null (or empty) strings as potentially invalid values. Other options available to the generator are to randomly modify a valid input (taken from the available ontology in stances) or to randomly generate a new one in order to try to produce an invalid value. Another generation rule available to the test generator involves the creation of an input value of the wrong data type (e.g., an al phabetic string where a numeric is expected). The full list of invalid input generation rules is provided in Table 1.2.

The generator aims at producing invalid inputs that are as diverse as possible, in an attempt to test the robustness of the agents under test, making sure that they still behave correctly in most invalid circumstances. According to the

book-trading ontology described above, the test generator knows that the property *pric*e is of datatype *float* and that there is a rule stating that *pric*e must be between 0 and 2000.

Datatype	Rule	Description
Numeric	**RIN1**	Value causing overflow (underflow)
	RIN2	Value violating rules in ontology
	RIN3	Value of different datatype
	RIN4	*null* value
Boolean	**RIB1**	Value of different datatype
	RIB2	*null* value
String	**RIS1**	Value violating rules in ontology
	RIS2	Value of different datatype
	RIS3	*null* value
	RIS4	Empty string
	RIS5	Randomly generated string
	RIS6	Randomly mutated valid string

Table 1.2: Invalid input generation rules

The generator may produce the invalid values -1, 2001 to test both sides of the boundaries. Values that are not of type *float m*ay be also used to exercise the agents under test.

Message generation. When generating the full message, the test genera tor applies the input combination rules described in Table 4.3. For valid messages, the only possibility is to use only valid input values. For invalid messages, the generator can choose either to have only invalid values, or to have interleaved valid and invalid values, or to have just one invalid value. Rule selection follows the general criteria of maximizing diversity, as explained below.

When a valid message can only be formed with inputs coming from an unique, existing instance, the more restrictive rule RVC2 must be applied instead of RVC1. If input values from different instances can be freely combined, we can use RVC1. When RVC2 must be used, one way to generate invalid inputs is mixing values from different instances, as scribed by RIC4.

Message	Rule	Description
Valid message	**RVC1**	All values valid
	RVC2	All values valid and from the same instance
Invalid message	**RIC1**	All values invalid
	RIC2	Invalid and valid values interleaved
	RIC3	Just one invalid value
	RIC4	All values valid but from different instances

Table 1.3: Input combination rules

Input space exploration. The generator uses coverage information to de cide how to explore the input space. The test generator gives priority to classes and instances never selected before. When instances are reused, if possible the

generator selects instances with low reuse frequency. When invalid inputs are produced, the generator chooses the so-far least-used invalid input generation rules.

1.3.1 Random generation

Random testing has been proven to be very effective in revealing some types of faults, especially those that result in crashing or raising exceptions (Mills et al. 1987, Thévenod-Fosse and Waeselynck 1993). In dynamic and open environments for MAS, random testing seems to be a natural choice because it can generate unpredictable scenarios, which likely happen in such environments.

We are interested in two types of test inputs: messages and environment settings. The following discusses the random generation of these types of inputs.

1.3.2.1 Random generation of messages

We propose an approach to random testing of software agents, composing of two steps, Figure 4.6. First, a communication protocol is randomly selected among the standard ones provided by the agent platform, e.g., FIPA Request Protocol (FIPA 2002b) and/or those specified in a library by human tester. Then, messages that are required by the protocol are randomly generated and sent to the agents under test. In order to insert meaningful data into the messages, a model of the domain data, coming from the business domain of the MAS under test, must be also supplied. The message format is prescribed by the agent environment of choice (such as the FIPA ACLMessage (FIPA 2002a)), while the content is constrained by a domain data model. Such a model prescribes the range and the struc ture of the data that are produced randomly, either in terms of generation rules or in the (simpler) form of sets of admissible data that are sam pled randomly. The model of domain data can be specified by means of an ontology as well, so ontology-based generation rules can be applied to generate message content.

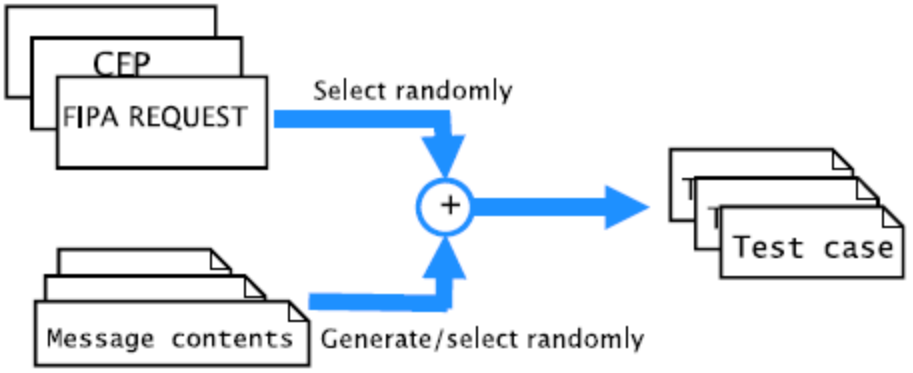

Figure 1.6: Procedure of the random generation technique

Randomly generated messages are then sent to the agents under test and it is the responsibility of our monitoring agent network to observe their responses, i.e., communications, exceptions etc. happening in the agent system. When a deviation from the expected behavior is found (condition violated or crash), it is reported to the development team.

A limitation of random testing of MAS is that long and meaningful interaction sequences are hardly generated randomly. However, it is often the case that agent interaction protocols need only few trigger messages, like those specified in (FIPA 2002b), or the agent under test needs only one message to trigger its goals. In these cases, random testing is a cheap and efficient technique that can reveal faults. Evidence is provided in the experimental chapter. For the generation of longer sequences that are inherently constructed so as to maximize the likelihood of revealing faults, more sophisticated techniques need to be used, such as manual or evolutionary.

1.3.1.2 Random generation of environment settings

Random testing can also be used to generate random contexts (i.e., environment settings) in which the agents under test operate. As some agents can be programmed to monitor and/or sense the surrounding environment, randomly generated environment settings can lead them to expose different behaviors, yet including faulty ones. Therefore, random generation of environment settings can be effective for agents that have active behaviors with respect to the environment, i.e., sensing, monitoring environmental artefacts.

For example, a cleaning agent has to clean an area in which there can be waste, waste bins, charging stations, and obstacles located at arbitrary locations. By placing these objects randomly, i.e., random generation, there can be some settings where the agent hits obstacles, which is a fault.

This technique can be done by (i) identifying the objects that link to the agent under test, (ii) identifying the attributes of the objects, and (iii) generate randomly values for these attributes. In the example above, we can generate randomly values for the location attribute of waste, waste bins, charging stations, and obstacles.

1.3.5 Evolutionary generation

The specific properties of software agents (autonomous, self-adaptive, learning, and so on demand for a framework that supports extensive and possibly automated testing. Therefore, we propose to apply ET (Evolutionary Testing) for testing software agents and define two methods to guide the evolution of test cases: mutation guided, and quality function guided.

In this technique, the agents under test are free to evolve during testing, but at the same time their behaviors are observed and used to guide the evolution of test cases, making them more challenging, to run again on the next cycle. Testing objectives, e.g., to see if an agent violates a constraint, are transformed into fitness functions to guide the evolutionary generation of test inputs.

The testing procedure is presented in Figure 1.7. It has the following steps:

1. Generate initial population A set of test cases is called *population.*

Each test case is an individual in the population. Initial population can be generated randomly or taken from existing test cases created by testers.

2. Execution and monitoring Test execution means to put the autonomous agents under test into the testing environment so that they can operate, i.e. performing tasks or achieving goals, or to send messages to them. At the same time, a monitoring mechanism is needed to observe the behaviors of the autonomous agents. Relevant observed data are recorded. Many executions might need to be performed repeatedly (or in parallel) in order to provide statistically sufficient data to measure fitness values in the next step. The agents under test might need a sufficient amount of time to perform their tasks.

3. Collect observed data and calculate fitness values. Cumulative data from all executions are used to calculate fitness values of selected test cases. The way of calculating fitness values depends on the stake holder's soft goal of interest and the problem domain. As calculated fitness values provide insights about the improvement towards the optimal ones, if no improvement is observed after a number of generations, the test procedure will stop. Otherwise step 4 will be invoked.

4. Reproduction. Two elite individuals are selected, and then crossover operation is used to produce two new off springs. Finally, mutation is applied with certain probability on one (or both) off springs. The two off springs are then put back to the population and the next iteration is triggered, i.e. go back to step 2.

In the following we define two fitness functions and methods to measure them.

CONCLUSION

In Conclusion, this chapter has discussed a novel testing method for software agents: continuous testing. It consists of automated test input generation, evaluation, monitoring techniques, and eventually automated execution.

Four generation techniques have been investigated. The goal-oriented one takes Tropos analysis diagrams, produced by using TAOM4E 4, to derive test suites to test for goal fulfillments. The ontology-based and random technique exploits available agent interaction ontology, interaction protocols, and domain data to generate messages ready to be submitted to the agents under test. The random technique can also be used to generate environmental settings. The advanced evolutionary technique implements the evolution algorithm to evolve existing test cases to produce new and more challenging ones based on runtime feedbacks. These feedbacks include the number of mutants killed (mutation-guided) or the distances to quality thresholds (quality-function-guided).

The following table, Table 1.4, summarizes the types of test input that these techniques generate so far:

Technique	Messaging type	Environment type
Goal-oriented	Yes	Yes
Ontology-based	Yes	No
Random	Yes	Yes
Mutation-guided evolutionary	Yes	No
Quality-function-guided evolutionary	No	Yes

Table 1.4: Testing techniques and test input types

For what concerns the evaluation of agent behaviors, we proposed to use constraints such as norms to detect faulty behaviors that violate these constraints. We proposed to use ontology to check if messages sending from agents are semantically and syntactically correct, and use requirements to judge if the agents under test are reliable given their autonomy. Monitoring technique is, then, used to observe, guard, and provide instant feedback information for test input generation.

Special agents including the TA and the monitoring agents are equipped with these techniques to make continuous and automated testing possible. The TA continuously generates or evolves test cases, using random, ontology-based, or evolutionary approach, and then executes them, while the monitoring agents monitor the behaviors of the agents under test, re port faults, and provide desired information for evolution.

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Internet of Things: Privacy and Security Perspective

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ABSTRACT

The Internet of Things (IoT) refers to a concept of connected objects and devices of all types over the Internet wired or wireless. Now a day's, we all are flanked by many smart devices and billions of devices are there connected on the internet and the number is increasing exponentially. These smart and brilliant devices are making our daily life so easier and more comfortable. These smart devices are used to communicate with each other in the universe. The popularity of IoT or the Internet of Things has increased rapidly, as these technologies are used for various purposes, including communication, transportation, education, and business development.

So, there is clearly a lot of data sharing online and everything has its pros and cons. For deception, data Privacy and security from numerous attacks is a major issue because our data always goes from one end to the other. Security must be addressed throughout the IoT lifecycle from the initial design to the services running. This is why we need a certain amount of security policies. In this paper, we are discussing about the background of IoT systems and security measures.

Keywords: *IoT, Security, Privacy, IoT infrastructure*

1. INTRODUCTION

After an every-single-day numbers of users areincreasing in the internet zone and all things depending on the network. Things are converted into digitalization. It is a prime segment of the internet's future [1]. IoT is a network method in both wired and wireless connection that consists of many devices and it can be software or it can be hardware like a tablet, laptop, computer, mobiles and it also utilized in managements section like hospitality, agriculture field, infrastructural, transportation field and manufacturing field. IoT is increasing day by day and after a couple of years it becomes huge part of network because everything in our life depends on internet. IoT is the basics of the modern world, such as hospitals, cities, institutions, and buildings. Through this IoT technology, every single device is interconnected all over the world because the device is holding a smart microchip in them and this smart chip is tracking the things nearby and inform to the humans. This IoT term changing the way of communication throughout the world and connects tangible or intangible devices with technology. Now it does tasks as humans with the meaning of Artificial Intelligence (AI) and Machine Learning (ML). After a couple of years, the whole world becomes a small place for us to connect with anyone [2]. The benefit of this IoT technique is we can easily share data or exchange data over the network everywhere at a very cheap cost but everything holds its pros and cons so, security and privacy are a major issue.

The information which we are sharing over the network is strolling everywhere in the cloud, therefore it increasing the threat reasons also. The data can be easily permeable by the cyber-attack because data is just a process, not a touchable product. Hence, this is requisite to study the privacy and general security issue. In this paper, we will discuss some points which are: -

2. CORE LAYERS OF IOT

IoT usually has four main components: observation, computing, application and services, heterogeneous use, and ancillary components. As a rule, IoT technology has to process the layers and divide them into four layers [3]. In a normal way, the IoT technique has layers for processing and it is separated into four levels.

- **Recognition layer**

The most underlying level is the recognition layer which also known as the Perception layer. It senses and integrates all types of data about the environment through the physical appliance.
It contains all kinds of data like senses other devices in the environment, includes RFID reader and GPS. The main factor in this layer is a sensor used for capturing and representing the physical universe in the digital world.

- **Network Layer**

This is the second layer in layers of IoT. This layer is responsible for the reliable transmission of data from the upper layer (Recognition layer). It performs connection activity in between smart devices. data transmission at this level is dependent on several essential networks for example internet, wireless network, client and server network, mobile communication, satellite networks, network infrastructure, and communication protocols also important for data transformation between devices.

- **Physical Layer**

The physical layer is the third layer in the layers of IoT. The physical level will establish a reliable resource platform for the next level in layers of IoT (Application level), on this resource platform all types of smart computing powers will be consolidated through grid network and cloud computing. It performs a vital role in the connection between the application layer and network layer.

- **Application Layer**

This is the next layer in the core layers. This layer performs all specific roles-related applications because it delivers all services to the requirements of the end-user. This is the terminal layers and from this layer end users can access the internet of things through this layer and there are many interfaces can be like mobile, TV (Television) laptop, PC (personal computer)

3. UNDERSTANDING IOT SECURITY CHALLENGES

A number of challenges prevent the securing of IoT devices and ensuring end-to-end security in an IoT environment. Because the idea of networking appliances and other objects is relatively new, security has not always been considered top priority during a product's design phase. Additionally, because IoT is a nascent market, many product designers and manufacturers are more interested in getting their products to market quickly, rather than taking the necessary steps to build security in from the start[4].

- A major issue cited with IoT security is the use of hardcoded or default passwords, which can lead to security breaches.
- Modern IoT ecosystems are complex.
- There is a bunch of hackers that would take advantage of a system's vulnerability.
- Machines and objects in virtually any industry can be connected and configured to send data over cellular networks to cloud applications and back ends.
- Unfortunately, diverse data types and computing power among IoT devices mean there's no 'one size fits all' cyber security solution that can protect any IoT deployment.
- Security Challenges must be mitigated for the entire IoT lifecycle of the deployment, especially as it scales and expands geographically.

4. SECURITY STRUCTURE IN IOT

A large data is transmitted over internet so there is also raise a risk in security of data concern, discussed some security purpose technology used in IoT (Cryptographic Algorithms, Communication Security, protecting sensor Data, Encryption Mechanism). The three security structures must be balanced to ensure intelligent implementation and use of mechanisms. Even for the DDoS attack the specific IoT architecture was proposed [5]. And the outline is as availability, secrecy, authenticity. The development of security and the rapid adoption of IoT technology has increased security concerns and created a sense of insecurity among IoT users.

The exact motive of this research is to negotiate the situation of the security perspective regarding the IoT. Now days all kind of data depends on the internet of things and it made our life so easier but apart from that, there is a big issue in data privacy concern [6].
Some security structures need to be equilibrated to secure wise execution and use of the network.

- **Availability**

The availability of the resources in an aspect of physical devices and information at anytime that is at a particular instance along with the proper access rights.

- **Secrecy**

The requirement of securing data and information is preventing our data from a threat.

- **Authenticity**

The convincement that the data which is transmitting from one end to another end is trustworthy and not fatal.

5. IOT PRIVACY CHALLENGES

The privacy of IoT (Internet of Things) aims to protect private information from unveiling to the IoT atmosphere, in which any physical or logical entity or object can be given a unique identifier and the capability to transfuse independently through the internet or an identical network [7]. As everything will be linked to intrusion within the network, entering only one portion of the network will disclose an individual, organization, or both.

- **Device Privacy**

Physical devices need security as in transferring data over the network. There is a chance of Susceptive data in IoT can be targeted when someone without any authentication accessing software or hardware [8]. As taking an example an assailant can be able to re-program an application in our phone to make it transfer information not to the authoritative server only, even to the assailant too. Mobile phone privacy means protection measures designed to secure the susceptive data stored on transmission by mobile, pc (personal computer), tablets, and many more devices. There is only one way to protect data and information from unauthorized invader or any accidental data loss is to combat viruses and other device conservation threats that can reveal a phone's data to the infiltrator.

- **During Communication Privacy:**

Information secrecy is a major thing when data circulating from one channel to another over the internet and for the security of data it using the technique which is "encryption techniques ". In some conditions, encryption is adding data to the packet to provide tracking. The secrecy communication protocol can give some privacy resolutions.

- **Storage Privacy and its processing:**

Conservancy of private data is essential a minimum amount of information must be stored to protect against any threat and accidental data loss [9]. Private data and very sentient information must be transfer in a method way and always consider the purpose of transferring or sharing data throughout the universe.

6. SECURITY PURPOSE TECHNOLOGY USED IN IOT

The benefits of IoT are undeniable, and yet, high-profile attacks, combined with uncertainty about security best practices and their associated costs, are keeping many businesses from adopting the technology.

- **Cryptographic Algorithms**

Many well-known and trustworthy algorithms are still used in cyber security sites. Typically, symmetric encryption algorithms are used such as the Advanced Encryption Standard (AES) block cipher, to ensure data confidentiality, Asymmetric algorithms have always been used for digital signatures and key transactions - the algorithm is often used by Rivest Shamir Adelman (RSA); The Diffie-Hellman (DH) asymmetric key algorithm is used for key agreement; And SHA1 and SHA-256 are used to connect secure algorithms. Another notable asymmetric algorithm is known as elliptic curve cryptography (ECC). The ECC is also providing its own conservation with shorter length keys. The ECC domain has slowed down and may be stimulating recently.

Using these cryptographic algorithms requires the speed of the process and the availability of resources such as memory. The quantum cryptography is also used for security in IoT domain [10]. Therefore, it is unclear how to use these cryptographic techniques in IoT, but we will focus on further investigation on whether algorithms can be successfully used in IoT with less memory and slower processors.

- **Communication Security**

Initially some solutions have been set up in communication protocols, these solutions can provide high truthfulness, authenticity and secrecy for communication, for example: IPSec and TLS/SSL. TLS / SSL are built to encrypt connections at transport level, and IPSec is built for keep safe network-level security, it can give high truthfulness, authenticity and secrecy at all levels [11]. Privacy requirements have also been met, but unfortunately, they are not widely used. So today communication security mechanisms are rarely applied. Because smaller IoT devices have less loading power, this often results in lower communication security. In the case of IoT, the main network is always new or future; it will transmit a lot of information online.

- **Protecting sensor Data**

The reliability and of the authenticity sensor data has been an investigation, the privacy of the sensor data is very low because when the attacker can place it in nearly physical area of the sensor it can detect the same pattern. That is why privacy requirements with special sensors are low. The purpose of other investigations is confidentiality, and privacy is also a major issue. We must use such methods to secure the privacy of human and physical objects. Most people are incognizant of the sensors in their lives, so we have to make laws to protect people's privacy. There are many guides in the literature to solve the problem in the design part: first, the user must know whether he has sensed or not, second the user can decide whether he can sense or not, third the user must be allowed to remanent anonymous. When the user does not understand these instructions, these rules should be given.

- **Patch management/continuous software updates**

Providing means of updating devices and software either over network connections or through automation is critical. Having a coordinated disclosure of vulnerabilities is also important to updating devices as soon as possible. Consider end-of-life strategies as well.

- **Encryption Mechanism**

In the IoT network level and the application level, they are very closely linked, so we must select in the middle of end-to-end encryption and By-hop. If we accept By-hop, we can only close the links that need to be protected, as we can apply to all companies in the network that offer different services. In this way, the security system becomes clear in the business environment, providing opportunities for simple users. Meanwhile, it brings the features of the by-hop full play, such as low latency, high performance, cheap cost etc. However, due to the process of decryption operation in the cation on the transmission node, the use of By-hop encryption method in each recording can achieve the plaintext message, so high-reliability by-hop encryption of the transmission node is essential.

7. CONCLUSION

Over the past years, IoT which is developing field of network and it has been attracting huge interest, and it will continue in the coming years. IoT involves adding internet connectivity to a system of interrelated computing devices, mechanical and digital machines, objects, animals and/or people. IoT transition of information and data between two insecure nodes and the physical security of an IoT device cannot be settlement because there is big deal in data security field. Each "thing" is provided a unique identifier and the ability to automatically transfer data over a network. Allowing devices to connect to the internet opens them up to a number of serious vulnerabilities if they are not properly protected.

It is a sensitive problem that data is not to be accessed and used by everyone. Using security model in IoT, it has been explored that each layer has its own properties, challenging task and privacy issues. Different kind or levels have different kind of results. Stealing of data is easy now so, its necessary to prevent data from attackers. We briefly reviewed about IoT security and analysed its needs and feature from layers which are perceptual layer, network layer, support layer and application layer. Then we discussed IoT privacy challenges in summarized way. Overall, the expansion of IoT will bring more significant privacy issue, which have always been the main focus and task of research.

IoT security has become the subject of scrutiny after a number of high-profile incidents where a common IoT device was used to infiltrate and attack the larger network. Implementing security measures is critical to ensuring the safety of networks with IoT devices connected to them.

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Cloud Computing: Privacy and Security Perspective

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ABSTRACT

The term cloud computing plays an important role in our lives because we are all related to this. Cloud computing has been envisioned as the next generation paradigm in computation. Cloud computing is used to store data and allow access to resources and used for virtualization. In the cloud computing environment, both applications and resources are delivered on demand over the Internet as services. Day by day, it has become very popular due to the advancements of software and information in cloud computing. However, there is also a different aspect of this cloud computing which is "cloud computing security". In the cloud computing environment, security and privacy of data becomes particularly serious because the data is located in different places even in the entire globe. Therefore, in this paper we will explore various aspects of data security ting environment. In this paper, we make a research analysis of the existing research work regarding the data security and privacy protection techniques used in the cloud computing. This paper also includes methods of securing data and methods that are used to reduce insecurities.

Keywords: *Cloud computing, Data security, Privacy, Public cloud, Private cloud, Hybrid cloud*

1. INTRODUCTION

The Cloud Computing is a new computing model which comes from grid computing, distributed computing, parallel computing, virtualization technology, utility computing and other computer technologies and it has more advantage characters such as large scale computation and data storage, virtualization, high expansibility, high reliability and low price service[1]. Cloud Computing provides shared resources and services with the help of Internet. Cloud computing is an example of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet. Cloud computing is an arrangement of computing services, such as servers, storage, databases, networks, software, inquiring, judgment. Cloud Computing provides a replacement to the on-establishesdatacenter.

With an on-establishes data center, we have to organize all the things in a manner, including purchasing and established hardware, virtualization, downloading the operating system, and any other necessary applications, location of the network, configuring the firewall, and setup storage for data. The security problem of cloud computing is very important and it can prevent the rapid development of cloud computing. This paper introduces some cloud computing systems and analyzes cloud computing security problem and its strategy according to the cloud computing concepts and characters. Despite the surrounding the cloud, consumers are reluctant to cloud their business. Security issues affecting the development of cloud computing are the biggest concern. It adds to the difficulties in data privacy and continues to affect the data security market. Users need to understand the risk of data breaches in the cloud. The article will highlight issues related to cloud computing.

2. NEED OF CLOUD COMPUTING

The basic example of cloud computing is Google apps. In this we don't require to download a piece of software on our local Personal Computer and this is the manner in which all dependency can be

overcome[2].This technique making our life so comfortable and it used to build applications for business and co-operate. This section includes some basic needs for which we can use cloud computing.

- **Financial**

Not all cloud computing, as a service requires end users to purchase software and hardware that are available at cheap cost. For example, buy a 500GB hard drive.

- **Automatic updating**

All software, which are present in the cloud they does not require to be updated manually, but are updated automatically.

- **Synchronization**

This cloud computing provides a bridge for latest atmosphere and distinct traditional. Taking an example like Google applications are running at every platforms and operating systems (MAC, Linux, Unix and Windows)

- **Scalability**

Scalability defined in relation of establishing latest hardware and software resources. For an example: AWS provides a service that builds virtual machines or servers to balance non-automatic loads.

- **Developed networking**

Cloud computing provides the networking connection between physical-to-physical device, virtual to virtual devices and cloud comprises router, table of routing and firewall etc.

- **Response time**

When a sender is requesting for any particular computation then how much time takes in loading by cloud that called response time. It indicated that how much time a cloud takes for response. To empower the timing of respond amazon executed Content Delivery Network in cloud computing main subjects are provided by edge locations.

- **Incoming technology**

It is using all advanced technology with Interfacing in legacy.Because of this reasons we can commit that cloud computing is the future of technology.

3. CLOUD SERVICES MODELS

There are three main cloud service models [3], which are as follows:

- **IAAS** (Infrastructure as a service)
  The layers of cloud computing platform where the customer's organization sources its IT infrastructure such as servers, networking processing, storage, virtual machines, and customers access these resources over Internet.Ex-WC2 (Amazon Elastic Compute Cloud).
- **PAAS** (Platform as a service)
  It is a developer-programming platform, which is created for the programmer to develop, test, run and manage the applications. A developer is able to write the application as well as display it directly into this layer easily.Ex-Microsoft Azure, Google app engine.
- **SAAS** (Software as a service)
  It is a software distribution model in which applications are hosted by a cloud service provider and made available to customers over Internet. SAAS is also known as 'On-Demand Software' for example: Office 365, Google sheet, Google word.

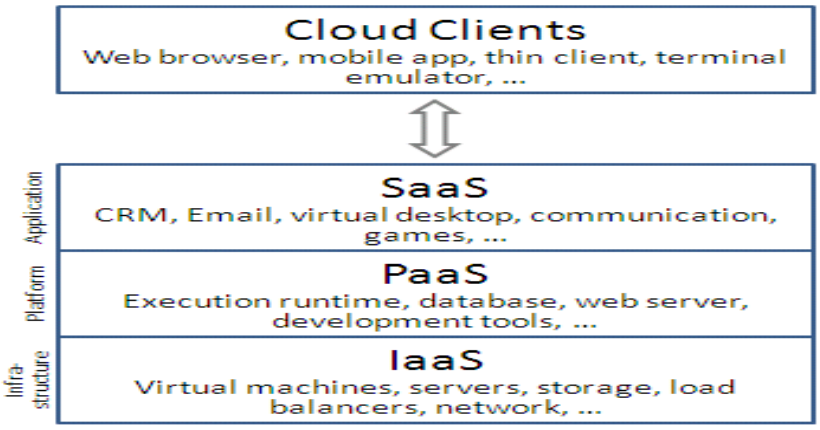

Figure 1. Cloud Service Models

4. CLOUD DEPLOYMENT MODELS

There are four cloud deployment models: public, private, community, and hybrid. Each deployment model is defined according to where the infrastructure for the environment is located [4].

i. Public cloud

It allows systems and service to be easily accessible to the general public. Public cloud may be less secured because of its openness. This cloud service is open for use.Ex- Email, Amazon, IBM, Microsoft, Google.The most common uses of public clouds are for non-mission-critical tasks such as application development and testing, file-sharing, and e-mail service.

Advantages:

- Flexible
- Reliable
- High Scalable
- Low Cost
- Place Independence

Disadvantages:

- Less Secured
- Poor Customizable

ii. Private Cloud

It allows systems and services to be accessible within an organization. It offers increased security because of its private nature.Private clouds permit only authorized users, providing the organizations greater control over data and its security. Business organizations that have dynamic, critical, secured, management demand based requirement should adopt Private Cloud.Private clouds are more expensive than public clouds due to the capital costs involved in acquiring and maintaining them.However, private clouds can best address the security and privacy concerns of organizations today.

Advantages:

- Highly private and secured: Private cloud resource sharing is highly secured.
- Control Oriented: Private clouds provide more control over its resources than public cloud as it can be accessed within the organization's boundary.

Disadvantages:

- Poor scalability: Private type of clouds is scaled within internal limited hosted resources.
- Costly: As it provides secured and more features, so it's more expensive than a public cloud.
- Pricing: is inflexible; i.e., purchasing new hardware for up-gradation is more costly.
- Restriction: It can be accessed locally within an organization and is difficult to expose globally.

iii. Hybrid cloud

It is a mixture of public and private cloud. The critical activities are performed using private cloud while the non-critical activities are performed using public cloud.Negative functions such as workloads can be developed and tested using the public cloud but private cloud performs important functions such as managing an organization's data.The advantages of both deployment models, as well as the community deployment model, can be found in hybrid cloud hosting.

Advantages:

- Flexible
- Secure
- Cost Effective
- Rich Scalable

Disadvantages:

- Complex networking problem
- Organization's security Compliance

iv. Community cloud

A specific community of consumers from organizations uses it. It may be owned, managed and operated by one or more of the organizations in the community. Ex-security, requirements, policy.Some ray of research includes collaborating universities, or police departments within county or state-shared computing resources.Access to a community cloud environment is usually limited to community members.

Advantages:

- Cost reduction
- Improved security, privacy and reliability
- Ease of data sharing and collaboration

Disadvantages:

- High cost if compared to a public deployment model
- Sharing of fixed storage and bandwidth capacity
- It is not widespread so far

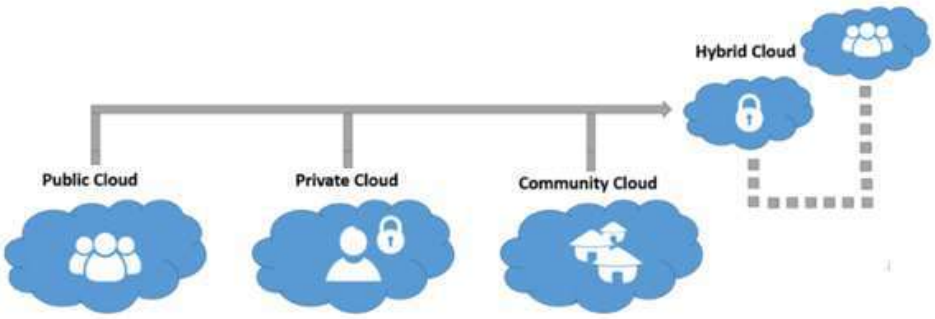

Figure 2. Cloud Deployment Models

5. CHALLENGES FOR THE CLOUD SECURITY

Security in the cloud is achieved, in part, through third party controls and assurance much like in traditional outsourcing arrangements [5]. But since there is no common cloud computing security standard, there are additional challenges associated with this. Many cloud vendors implement their own proprietary standards and security technologies, and implement differing security models like tounge biometrics[6], which need to be evaluated on their own merits.

i. DDOS(Distributed Denial of Service):

It is refusing the providing of services to authorize and actual clients due to fake number request Intruders and attackers on the server[6].Unsuccessful attempts are aimed at disrupting the normal flow of services, communications or communications through major events and Internet flood system regulations.

ii. Data disposal

Cloud data deletion and disposal is a risk, particularly where hardware is dynamically issued to customers based on their needs[8]. The risk of data not being deleted from data stores, backups and physical media during decommissioning is enhanced within the cloud.

iii. Data Breaches:

It means opposing the rules, regulations and policies of different countries and governments.Transparent information can be rejected as a result of information breach. Violations can lead to a number of important things, including data theft. In the age of cloud computing, criminal information is of particular concern. Following are some data breaches in cloud computing:

- Stolen Information
- Password Guessing
- Recording Key Strokes
- Hacking

iv. Data Loss:

It means there should not any data loss incidently and due to any type of attack mirroring and backuping of data is so strong there will not any data loss up to any disasters[9]. Information is lost when important or sensitive information on a computer is damaged by theft, human error, viruses, malware, or a power outage. Servers can also suffer from lost data, just as individual computers and devices can.

v. Authentication:

When we consider about the cloud computing authentication with other normal web application authentication, we would find a little difference in cloud authentication. Other than the normal web application cloud computing application provides several numbers of unique services to the consumer [10].

vi. Data location and segregation

Customers may not know where their data is being stored and there may be a risk of data being stored alongside other customers' information [11].

vii. Insecure access points:

When you are designing a public system, there may be any loss in terms of transport parts or public user policies.

viii. Insider and organized crime threat:

Cloud providers will store a range of different data types, including credit card and other financial and personal data. All of this data may be aggregated from multiple customers and therefore be extremely

valuable to criminals [12]. There is a risk that insiders are deliberately used to gain access to customer data and probe systems in order to assist any external attackers that require additional information in order to execute complex Internet-based attacks. Cloud customers should ensure that service providers are aware of this threat and have rigorous identity validation and security vetting procedures built into their recruitment process.

6. CONCLUSION

Cloud computing is a new project that shows many benefits to its users. But it also raises some security issues affecting its use. Understanding the vulnerabilities inherent in cloud computing will help organizations use the cloud. Many technologies have solved their security problems with cloud computing. However, traditional website applications are under control, but some cloud-based solutions are not mature or resilient. We identified security issues for cloud models: IAAS, PAAS, and IAAS, as opposed to a model. As this article says, storage and network connections are more important when it comes to computer security. Virtualization that allows multiple users to share the rights of a physical provider is a concern for cloud users. Virtual networks are the target of some attacks. We focused on this difference, where understanding these issues was considered important. Another important feature of cloud computing is its versatility.

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A Review paper on Six Stroke Engine

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ABSTRACT

In present life style we daily use various kind of automobile vehicle in which we mostly use IC engine as power source. But IC engines produces harmful gases at high temperature as exhaust due to which air pollution is continuously rising. In tends to reduce this pollution six stroke engine is introduced. Six stroke engine have two additional stroke in four stroke engine. It have same concept as four stroke engine but two additional stroke is used to remove heat from engine or utilize engine heat losses to useful work output by reducing temperature of engine. In additional two stroke air, water or steam can be passed through engine to reduce its temperature. As water or steam passes through engine it absorb heat from engine and use this heat to push piston in IC engine. As we improve the efficiency of engine and also reduce pollution. As well as extracting power, the additional stroke cools the engine by water and removes the need for a cooling system making the engine lighter and giving 40% increased efficiency over the normal Otto cycle. The pistons in this six stroke engine go up and down six times for each injection of fuel. These six stroke engines have 2 power strokes: one by fuel, one by steam.

Keywords: *IC ENGINE, FOUR STROKE, SIX STROKE, POLLUTION*

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1. Introduction

In present scenario fuel prices are increasing day by day and air pollution is increasing as well. Motor vehicle emissions contribute to air pollution and are a major ingredient in the creation of smog in some large cities. A study indicates that 53,000 early deaths occur per year in the US alone because of vehicle emissions. According to another study traffic fumes alone cause the death of 5,000 people every year just in UK. In tends to reduce pollution and increase thermal efficiency of engine many research has been done. In that research a six stroke engine has also been introduced. Six stroke engines is similar as four stroke engine but in six stroke engine an additional cycle has introduced to reduce temperature of engine and as the temperature of engine reduced, harmful gases emission has also been reduced by this. In the additional six stroke engine we can introduce water or steam to reduce the temperature of the combustion chamber directly so water or steam absorb heat over there because of high temperature of combustion chamber. Now the absorbed heat can be used to run an additional cycle and it create additional two strokes**.**

2 Design of Six Stroke Engine

Six stroke engines are same as four stroke engine but it has a slight modification in its design. That is it have four valve at cylinder head two are the traditional vale which are used for inlet and exhaust but another two are for the extra two stroke which are used for intake and exhaust of water and steam. Now as there is change in the no stroke in the engine so it also require changes in camshaft and crankshaft to arrange the balance the timing of opening of all four valves and firing time.

2.1 Design of Crank Shaft

To balance all functions of valve operation properly there is a need of modification in gear ratio of cam and crank shaft. As we know in four stroke engine there is four stroke in one cycle so it require one revolution of cam shaft for

the two revolution of crankshaft. But in six stroke engine it have six stroke in a single cycle so it require one revolution of cam shaft for the three revolution of crankshaft. So gear ratio of cam shaft and crank shaft should be 3:1.

2.2 Design of camshaft:

As we know in six stroke engine there is four valve operate over the cylinder head but the traditional cam shaft of four stroke engine can only operate two valves so there is a need of modification in the cam shaft to operate all four valves in single revolution of cam shaft. When camshaft rotates 360 degree in six stroke engine, the cam has been divided into 60 degree among the six strokes. There are two exhaust strokes, one will be at the time of fourth stroke and the second one is at the six strokes which pushes steam out and there will be two intake first for fuel intake and the second for water intake.

2.3 Design of Cam follower

The shape of follower which is used in four stroke engine is flat from the bottom. But when reducing the duration of opening the valve from 900 degree to 600 degree only the shape of the follower must be changed.

3. Engine functionality:

The different strokes are:

1. Intake stroke
2. Compression stroke
3. Power stroke
4. Exhaust stroke
5. Water intake
6. Steam exhaust

The engine has four valves:

1. Air-fuel intake valve
2. Water intake valve
3. Combustion exhaust valve
4. Steam exhaust valve

Intake stroke: In this stroke, the piston moves from top dead center (TDC) to bottom dead center (BDC). The intake valve opens and the air-fuel mixture enters the cylinder.

Compression stroke: The piston moves from BDC to TDC, and all valves are closed.

Power stroke: The spark plug ignites the air-fuel mixture. The piston moves from TDC to BDC, while all valves remain closed.

Exhaust stroke: The piston moves from BDC to TDC while the exhaust valve opens, allowing exhaust gases to exit the cylinder.

Water intake stroke: The water intake valve opens while the piston moves from TDC to BDC, pulling water from the additional tank into the cylinder. This water absorb heat of combustion chamber and expand by converting into steam which push piston to BDC, while cooling the inside of the cylinder.

2nd exhaust stroke: The 2nd exhaust valve opens while the piston moves from BDC to TDC. The expanded steam get exhausted due to the temperature difference.

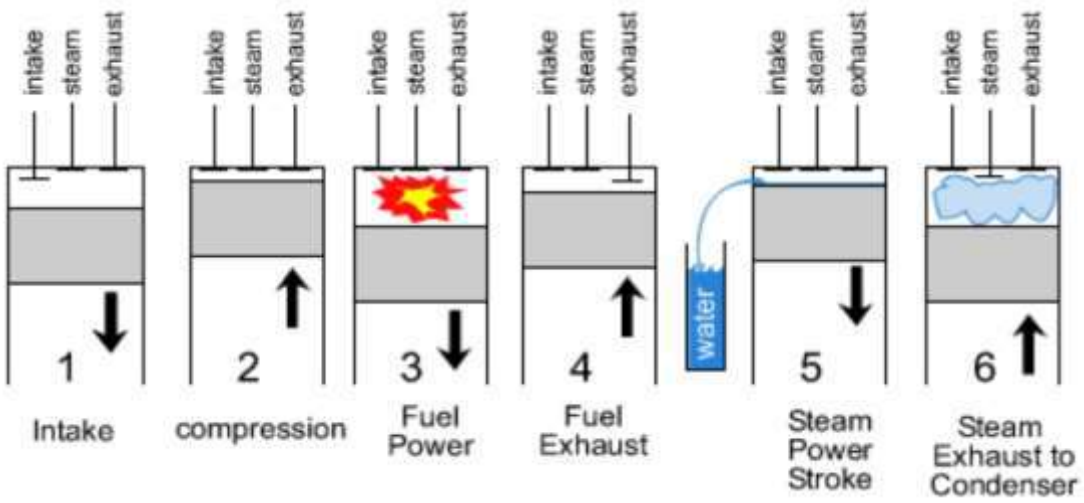

Fig1: working of six stroke engine

4.1 Comparison of four stroke engine and six stroke engine

In a six-stroke engine prototyped in the United States by Bruce Crower, water is injected into the cylinder after the exhaust stroke and is instantly turned to steam, which expands and forces the piston down for an additional power stroke. Thus, waste heat that requires an air or water cooling system to discharge in most engines is captured and put to use driving the piston. Crower estimated that his design would reduce fuel consumption by 40% by generating the same power output at a lower rotational speed. The weight associated with a cooling system could be eliminated, but that would be balanced by a need for a water tank in addition to the normal fuel tank.

4.2 comparison of fuel flow rate:

- Amount of fuel supplied to the engine per unit time is the fuel flow rate.
- As the diagram shows the fuel flow rate of 6-stroke engine is 50% lesser than the conventional 4-stroke engine

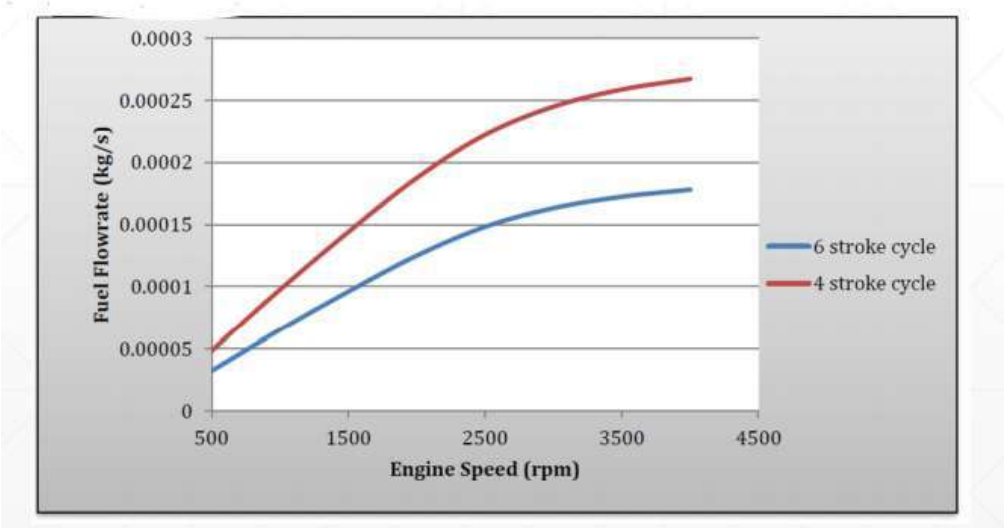

Fig -2 air flow rate

4.3 Comparison of Thermal efficiency:

The thermal efficiency of the engine is the power produced by the engine to the power available from fuel. The thermal efficiency of the four stroke engine lies between 20-30%, where as The thermal efficiency of six stroke engine lies between 40-50%

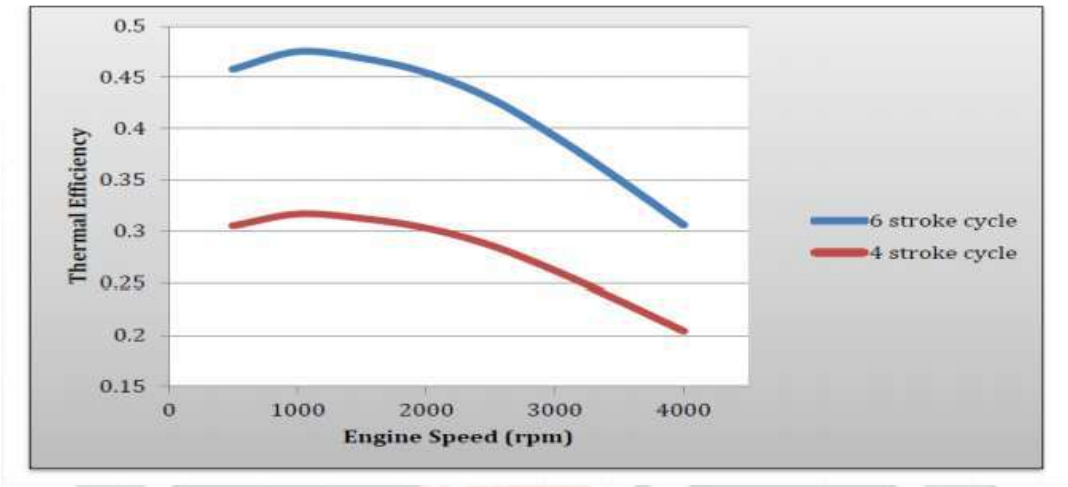

Fig -3 air flow rate

5. CONCLUSIONS

Six stroke engines have many advantages like high thermal efficiency, low fuel consumption, high break mean effective pressure, and low emission. However drawbacks like initial starting problem, availability of water are also associated. The starting problem can be eliminated by using heater or glow plug and coupling a dc motor as prime mover to the engine. Nowadays research and experiments are going on to modify the engine further and to make it suitable for practical purpose

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ELECTROCARDIOGRAM (ECG)

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ABSTRACT

ECG conveys information regarding the electrical function of the heart, by altering the shape of its constituent waves, namely the P, QRS, and T waves. ECG Feature Extraction plays a significant role in diagnosing most of the cardiac diseases. One cardiac cycle in an ECG signal consists of the P-QRS-T waves. This feature extraction scheme determines the amplitudes and interval in the ECG signal for subsequent analysis. The amplitude and interval of P-QRS-T segment determine the function of heart. Cardiac Arrhythmia shows a condition of abnormal electrical activity in the heart which is a threat to humans. This paper presents a method to analyze electrocardiogram (ECG) signal, for the classification of heart beats according to different arrhythmia. Synthesis of bio lubricants from by-products of soybean oil processing using the lipase from Candida rugosa (CRL) both in free and immobilized forms, as biocatalysts. Soybean fatty acid distillate (SFAD) was used for first time as source of free fatty acids (FFA) to produce bio lubricants via their enzymatic esterification with neopentyl glycol (NPG) and trimethylolpropane (TMP) alcohols in a solvent-free medium. Conversions of about 80 % were obtained using lyophilized CRL after 30 or 180 min using NPG and TMP, respectively. When CRL-PMMA/PMMA was used to catalyze the synthesis of NPG esters, 90 % conversion was achieved after only
6 h, whilst CRL-Accurel were more active using TMP. The biocatalysts maintained the reaction conversion during eight batches of 24 h.

Keywords— *ECG Electrocardiogram Classification Database QRS Feature extraction Feature selection Pre-processing.*

I. INTRODUCTION

The evaluation of the quality of electrocardiogram (ECG) after compression is an essential part of compression in the broadest sense. Compression reduces the amount of data, which facilitates signal archiving, speeds up signal transmission (especially important in telemedicine), and reduces energy consumption. On the other hand, compression usually results in loss of signal quality. This arises in the case of loss compression, which is the most commonly used technique because of its high efficiency. Indeed, while the quality of the signal after lossless compression is preserved, the efficiency is low. The aim of compression is to maximize the reduction of data amount while preserving the quality (diagnostic information). This naturally results in a compromise between efficiency and quality. It is thus desirable to express the compression performance through both efficiency and quality to avoid misunderstanding. Therefore, early detection of the patients at risk, and a better understanding of the disease mechanisms are crucial to improve diagnosis and treatment. Widely used by clinicians as A routine modality in hospitals, electrocardiogram (ECG) recordings capture the propagation of the electrical signal in the heart from the body surface. Therefore, many cardiac structural or electrophysiological abnormalities have a signature on the ECG and their identification can help diagnose cardiac disorders. ECG recordings include different formats: Holter ECGs record the electrical activity of the heart over longer periods of time (several hours), whereas standard 12-lead ECGs provide information on cardiac activity from 12 different perspectives (leads) over several heartbeats.Manually studying large amounts of ECG data can be tedious and time-consuming. Therefore, there is a need for powerful computational methods to maximize the information extracted from comprehensive ECG datasets. A neural network consists of an interconnected group of artificial neurons, and it processes information using a connectionist approachto computation. In most cases a neural network is an adaptive system that changes its structure during a learning phase. Neural networks are used to model complex relationships between inputs and outputs or to find patterns in data.

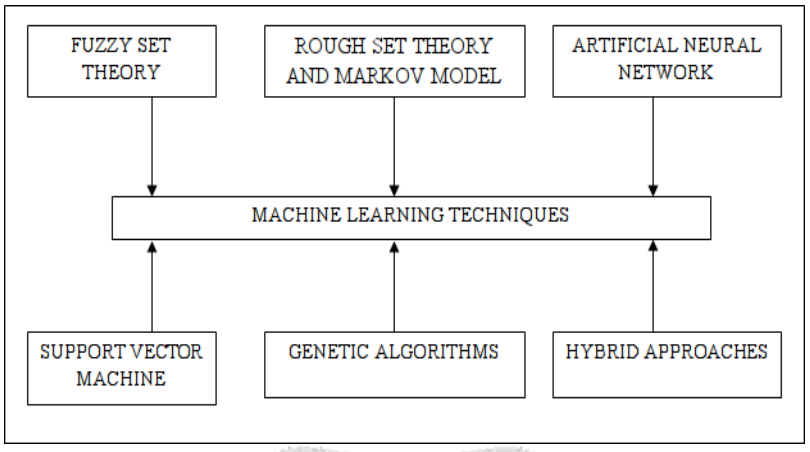

Figure 1: Schematic representation of normal ECG

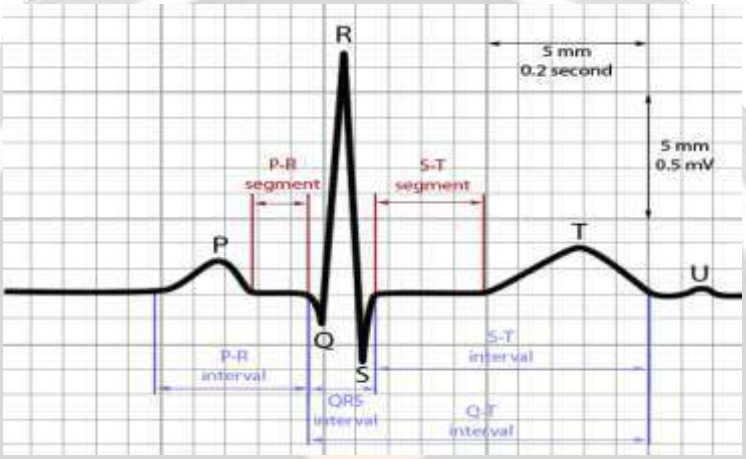

Figure2: Various Machine Learning Approaches used

ECG is essentially a time series signal that reflects the electrical activity of the heart. The signal consists of a series of repetitive and stereotyped complex waveforms with an obvious frequency of approximately 1 Hz. The heartbeat can vary across individuals and within individuals depending on a variety of conditions. The first stage in developing an automated machine learning techniques in ECG classification is to extract characteristic features from the waveform. Some features are considered first order, these features can be derived directly from the data such as RR time (time between the largest peaks that occurs in each heartbeat).

In a typical supervised classification scheme, the features are labelled with the decision outcome. The block diagram in figure 2 shows the different approaches used in automated machine learning techniques for investigating accurate results from ECG.

II. BACKGROUND

The existing studies and various researchers have investigated the domain of Automated Computerized ECG for effective diagnosis of heart diseases. This review, therefore, is an attempt to critically explore the literature in the area of different algorithms and machine learning techniques in ECG analysis.

Fuzzy Based Techniques Numerous methods have been developed to enforce computerized ECG analysis and diagnosis. Fuzzy sets or fuzzy based machine learning is an approach that is commonly deployed for effective ECG analysis. These techniques utilize smooth variables with membership functions in diagnosing diseases using ECG analysis (Lei et al., 2007). Moreover, in modern medicines, large amount of data is processed pertaining to diseases such as coronary artery diseases, for which, different classifiers are used to analyze the ECG (Pal et al., 2012). For this purposes, Beheaded & Chichi, (2013) conducted a study on assessing the cardiac abnormalities by optimizing the classification of cardiac arrhythmias and detection of abnormalities. The researchers used fuzzy decision tree as a methodology to diagnose the cardiac

abnormalities. They used the data pertaining to heart beat from MIT-BIH database. The proposed fuzzy tree is able to detect the anomalies of premature ventricular contraction, where the false alarm rate is reduced to 19.76% and the classification rate is 71% (Beheaded & Chichi, 2013). However when compared to neural networks and other techniques, the result is unsatisfactory. In alignment to this study, Lei et al., (2007) developed an adaptive fuzzy ECG classifier for enhancing the performance of conventional classifiers. The classifier used MIT-BIH arrhythmia database for evaluation. The developed classifier is effective in terms of self-adaptation as per the inputs of ECG signal. Average correct rate is found to be 88.2%. However, both these approaches lack in terms of comprehending the different types of heart beats. Also, the computational efficiency of the proposed approach (Lei et al., 2007) is significantly high.

ECG is widely used in the diagnosis of heart diseases, where fuzzy inference systems can be used for effective system analysis (Goel et al., 2016). The research on fuzzy based techniques have further developed through the incorporation of neural networks, such as fuzzy inference networks (Lei et al., 2007), that integrates the benefits of neural networks for better learning and fuzzy sets for better human understanding (Guler & Ubeyli, 2004). In a similar manner, Ceylan et al. (2009) used Fuzzy Clustering Neural Network Algorithm for classification in ECG analysis. The researchers aimed at increasing the accuracy rate for ECG beats, for which MIT- BIH databases of 92 patient records are extracted. Also, type 2 fuzzy mean clustering algorithms and back propagation 402 learning is used. The proposed system resulted an accuracy of 99% with acquisition of highclustering performance. It is inferred from the review, that the training time was large in this case, which limited the benefits. Also, for future research, a larger sample can be taken. Therefore, it can be inferred that the fuzzy sets are best used for demonstrating the data under uncertainties, for which the fuzzy logic is efficient in providing an inference mechanism. The output generated from fuzzy logic can be applied to knowledge based systems in ECG analysis (Jeyalakshmi & Robin, 2016).

The fuzzy decision tree provides a certain inferences and knowledge acquisition means to deal with multi-varied data, with complex or missing values (Chen et al., 2009). For the above purposes, it is widely used as interference and expert systems to provide clarity. In medical science stream, Pal et al. (2012) developed a fuzzy expert system for accurate detection of coronary artery diseases and removal from uncertainties emerging from the medical data. The researchers emphasized on the rule organization in tree representation for obtaining efficient search from the database pertaining to Coronary Artery Diseases (CAD). Therefore, it is inferred that fuzzy based techniques are effective in computerized ECG analysis but requires further investigation for attaining higher level of accuracy, especially pertaining to the localization of culprit coronary artery in ST Elevation Myocardial Infarction (STEMI).

III. PROBLEM FORMULATION AND PROPOSED SOLUTION

An expert Cardiologist will not be able to monitor a large number of cardiac patients efficiently and so computer aided feature extraction and analysis of ECG signal for disease diagnosis has become necessary. The input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation.

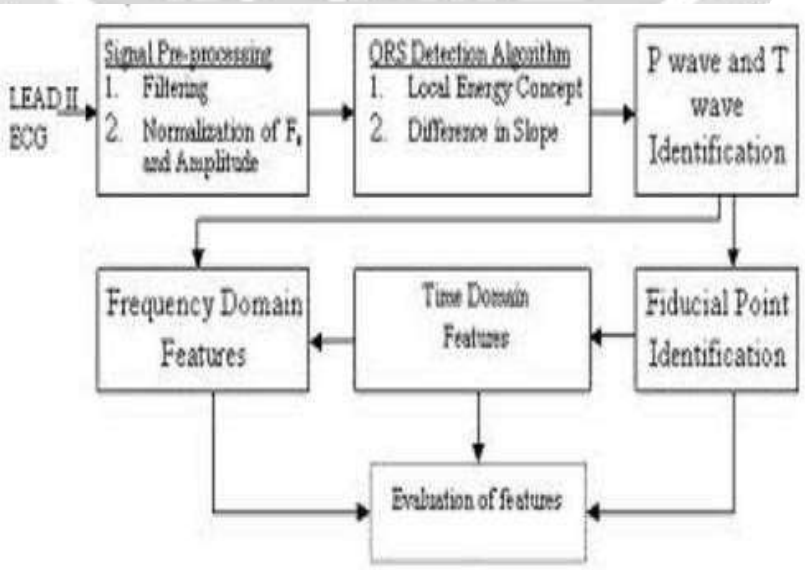

Figure 3.Steps in Feature Extraction

The flowchart in Figure.4 indicates the steps involved in Feature Extraction. For the purpose of diagnosis, we need to extract various features from the preprocessed ECG data, including QRS intervals, QRS amplitude, PR intervals, ST intervals etc., In this kind of analysis, identification and extraction is the first step. The most prominent feature here is QRS complex and the accurate detection of QRS complex forms the basis for the extraction of other features.

There are four approaches to feature extraction viz 1) Syntactic Approach 2) Non Syntactic Approach 3) Hybrid Approach 4) Transformative Approach. Of these the Non Syntactic method is widely used. In the Transformative Approach, the use of Wavelet Transform (WT) in QRS detection

Saxenaet all developed a combined Wavelet transform Technique to analyze multilead ECG signals for cardiac disease diagnosis. Here two wavelets have been used: One is the Quadratic Spline Wavelet (QSWT) for QRS detection and the other Daubechies Six Coefficient (Db -6) wavelet for P and T detection.

Shahanaz Ayub et al in their extraction of fusion beats of ECG, aim at making the analysis of fusion beats easy so that the patient could be diagnosed for the heart problems in less time and with more accuracy using Artificial Neural Networks. The identification of fusion beats is done using MATLAB based Feed Forward Neural Network. For training and validation of the neural network, the standard MIT – BIH arrhythmia database is used.

The Feed Forward network based on back propagation algorithm with training algorithm was the best for the analysis of fusion beats because it gives an accuracy of about 96%.

RESULT

S. No	**Name of abnormality**	**Characteristic features**
1	Dextrocardia	Inverted P-wave
2	Tachycardia	R-R interval < 0.6 s
3	Bradycardia	R-R interval > 1 s
4	Hyperkalemia	Tall T-wave and absence of P-wave
5	Myocardial	Ischaemia Inverted T-wave
6	Hypercalcaemia	QRS interval < 0.1 s
7	Sinoatrial block	Complete drop out of a cardiac cycle
8	Sudden cardiac death	Irregular ECG.

Classification with regard to ECG refers to categorizing the various features of waves extracted from ECG according to the specific heart disease each feature represents, and this classification is done with the help of Artificial Neural Networks. Classification is done generally according to the Table 2 given below. Various characteristic features of the patterns of ECG wave are listed and the corresponding disease to each pattern is also given An ECG contains important pointers to the nature of diseases afflicting the heart. Acharya et al classified cardiac abnormalities into 8 classes. Three

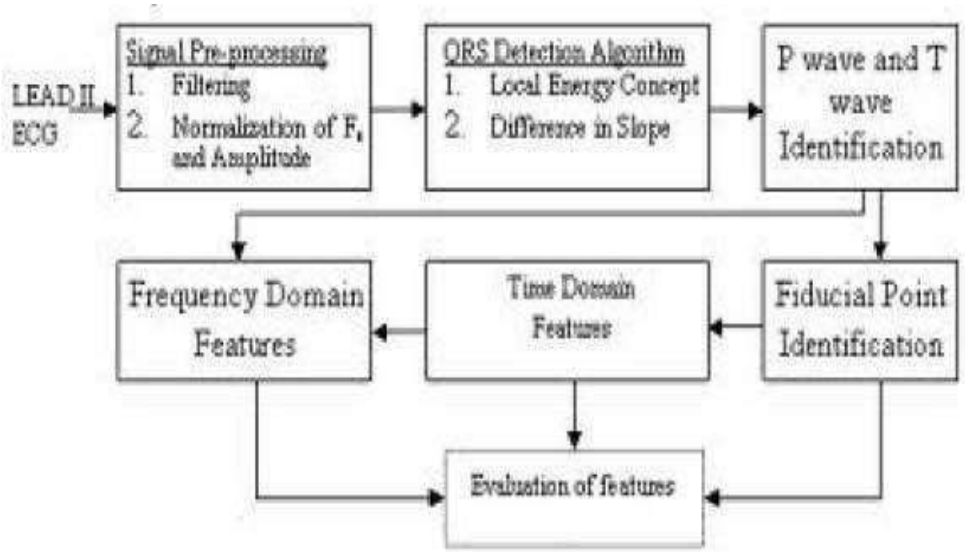

Figure 4. Abnormalities into 8 Classes

Parameters were extracted from the heart rate signals and usedfor this classification.

	No.of dataset used for trainin g	**No.of dataset used fortesting**	**Percentage ofcorrect classification (10,000 iterations)**
Left Bundle Branch Block(LBBB)	28	14	85.7
Normal Sinus Rhythm(NSR)	60	30	90
Pre VentricularContraction (PVC)	45	25	88
Atrial	30	25	85
Diseases classified by ANN	No.of dataset used fortraining	No.of datasetused for testing	Percentageofcorrect classification(10,000 iterations)
Left BundleBranch Block(LBBB)	28	14	85.7
Normal Sinus Rhythm(NSR)	60	30	90
Pre VentricularContraction (PVC)	45	25	88
Atrial	30	25	85

Acharya et al have used HRV signal as a reliable indicator of heart disease. They used neural network classifier and thefuzzy classifier as diagnostic tools to aid the physician in the analysis of heart diseases. These tools yield results with 80 – 85% accuracy and not 100% An ECG contains important pointers to the nature of diseases afflicting the heart. Acharya et al classified cardiac abnormalities into 8 classes. Three parameters

were extracted from the heart rate signals and used for this classification.

Acharya et al [6] have used HRV signal as a reliable indicator of heart disease. They used neural network classifier and the fuzzy classifier as diagnostic tools to aid the physician in the analysis of heart diseases. These tools yield results with 80 – 85% accuracy and not 100%

Surendra Dalu et al [10] have done classification of QRS and ST segment using Long Vector Quantization (LVQ) neural network. As a new approach LVQ which belongs to the class of competitive long networks, was developed particularly for classification problems.

QRS complex:

QRS complex is the electrical wave that signals the depolarization of myocardial cells of the ventricles. The duration of the normal QRS is not greater than 3 mm or 0.06to 0.12 seconds. If this duration is more than 3 mm it is to be suspected as an abnormal intra ventricular conduction velocity

Figure 5: Lead Electrocardiogram showing ST segmentelevation (orange) in I a VL and v1 –v5 with reciprocal changes (blue) in the inferior leads, indicative of an anterior wall myocardial infarction.

IV. CONCLUSION AND FUTURE WORK

The discussion so far made shows that new techniques are being evolved by researchers in each process involved in signal analysis so that more accuracy is achieved and treatment is given before it is too late. There is scope for future research in each process leading to 100% accuracy.

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A STUDY ON MECHANICAL VENTILATOR

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ABSTRACT

Mechanical ventilator is a machine to help a person to breathe, when they find difficulty in breathing on their own. The principle of a mechanical ventilator is to create a pressure gradient for the act of moving air into and out of the lungs. The ventilator makes sure that the patient receives adequate oxygen and removes the carbon dioxide. A mechanical ventilator effectively ventilates all patients in all settings, invasively and noninvasively. In invasive ventilation a tube is inserted into the patient's airway (trachea), and in non-invasive ventilation face or nasal masks are used which is based on patient's comfort and efficacy. Since 1940, 4 distinct generations of ICU (intensive care unit) ventilators have existed, each with new technology and features. For the proper controlling of air, closed loop technology is used in it.

- *The aim of this study is the designing and mechanism of mechanical ventilators.*
- *Study on comprehensive ideas in regard to its need, components, uses, effectiveness and applications.*
- *Extensive study on new advancement of mechanical ventilators.*

INTRODUCTION

The respiratory system is the most important part for survival of a human being, without it one couldn't survive. One who physically unable to breathe, a device is used named as Ventilator which gives the artificial breathes to patient. That means a mechanical ventilator is a device that transfer air into or out of the patient's lungs, and exchange the oxygen and carbon dioxide. It is used when a patient's lungs cannot supply enough oxygen on their own. Ventilators can give a patient's body time to rest when breathing is difficult. Principle of Mechanical ventilator is based on Boyles law which states that Air always flows from a region of higher pressure to a region of lower pressure, in order to initiate a breath, there must be a drop in alveolar that is pertaining to the tiny air sacs of the lungs pressure for air to flow into the lungs. It can be used in the hospitals for intensive care unit, or even to extended care at home.

The mechanics of ventilation are Elasticity, compliance, resistance, pressure, and gravity. The user interference (control panel) on mechanical ventilator is the surface located on the ventilator and is monitored and set by the operator. It has various knobs or touch pads for setting components, such as tidal volume, rate, in aspiratory time, alarms, and FiO_2. Now days, most ventilators are touch-screen so there aren't any knobs.

TERMS USED IN MECHANICAL VENTILATOR

TIDALVOLUME**:** [1]

Tidal volume is the volume of air displaced between inhalation and exhalation in a normal respiratory cycle. The tidal volume breath depends upon the patient's ideal body weight. It traditionally ranged from 4 to 12 mL/kg. In a healthy, young human, tidal volume is approximately 500 mL per inspiration or 7 mL/kg of body mass. Tidal volume plays a vital role in mechanical ventilation to ensure adequate ventilation without damage to the lungs.

RESPIRATORY RATE:[2]

A respiratory rate is the number of breaths takes per minute. It is also known as number of predefined tidal volume receives per minute. Respiratory rate for mechanical ventilator may range from 0 to 60 breaths/min. The respiratory rate for a healthy person at rest is 12 to 20 breaths per minute. A respiration rate under 12 or over 25 breaths per minute considered as abnormal.

FLOW RATE:[3] [4]

The peak inspiratory flow rate is the volume of gas delivered to the patient's lungs per unit of time. Flow rate is expressed in litters/minute. 60 and 120 L/min flow rate is the Most delivered rate for the ventilators. The ratio of

inspiratory/expiratory (I: E) for respiratory cycle is 1:2, but patients with severe pulmonary critical care illness may require an inverse I: E that is expiration/inspiration of 2:1 or 4:1.

ALVEOLAR PRESSURE:

Alveolar pressure is the pressure of air inside the lung alveoli, and it is also a difference of tidal volume and dead space and multiply by respiratory rate, means (tidal volume- dead space) *respiratory rate/min. Alveolar pressure defined as flow of air into or out of the patient's lungs.

INTRAPLEURAL PRESSURE:

Intrapleural pressure or intrathoracic pressure is the pressure inside the pleural cavity. Intrapleural pressure is slightly less than the atmospheric pressure, known as negative pressure. It depends on the ventilation phase, volume of the intrapleural cavity, and the atmospheric pressure. When the intrapleural pressure becomes equal to or greater to the atmospheric pressure, the pleural cavity is damaged, and it may lead to pneumothorax (the presence of air in between the lungs and chest wall, causing collapse of the lung).

In intra-pulmonary pressure and intra-pleural pressure, pressure becomes more negative during inspiration which causes air to travel inside or sucked in (according to Boyle's law), and during expiration, the pressure becomes less negative still less than atmospheric pressure and air is given out. The intra-pleural pressure is more negative than intra-pulmonary pressure.

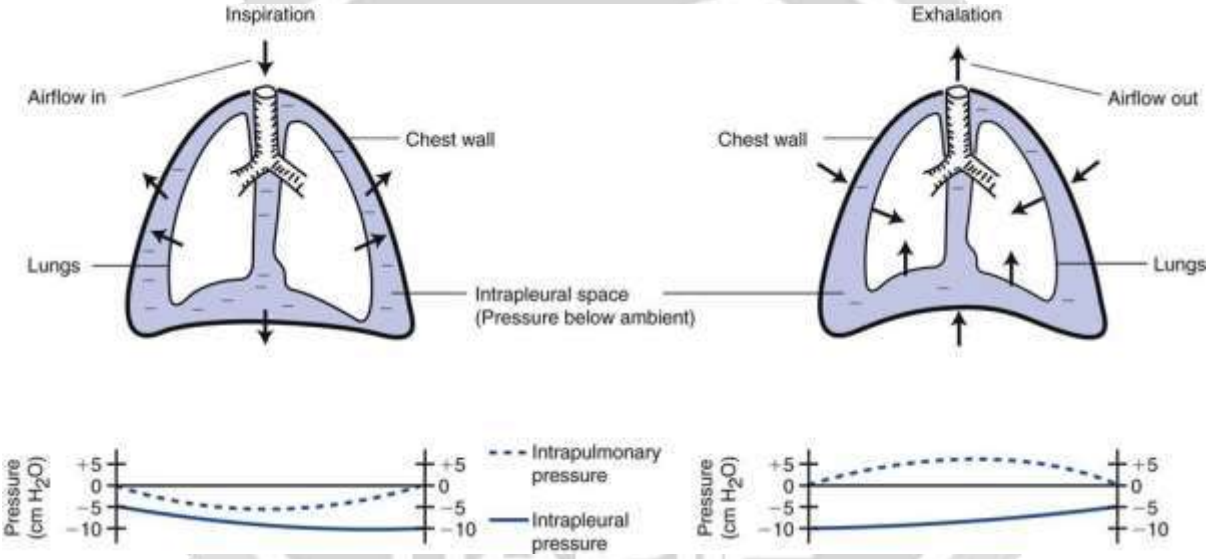

Fig. 1: Transpulmonary pressure

NEGATIVE PRESSURE VENTILATOR:

Air is flows because of pressure gradients. The principle of negative pressure [5] ventilator is applying a discontinuous sub-atmospheric pressure to the chest wall and abdomen; this will increase transpulmonary pressure which is pressure difference between the alveolar pressure and the intrapleural pressure in the pleural cavity, and causes atmospheric pressure at mouth to expand the lungs.

For nineteenth century and the primary 1/2 of of the 20 th century the bad-stress ventilator [6] changed into the essential tool used to offer ventilator assistance. The first test bad stress ventilator changed into a full-frame kind ventilator. This "**tank ventilator**" changed into first defined in 1838 with the aid of using the Scottish health practitioner John Dalziel. It consisted of an air-tight box, with the affected person preserve with inside the sitting position. This ventilator changed into set up with the aid of using manually pumping air into and out of the box. The tool changed into ready with a stress gauge to reveal the volume of bad stress set up with inside the tool.

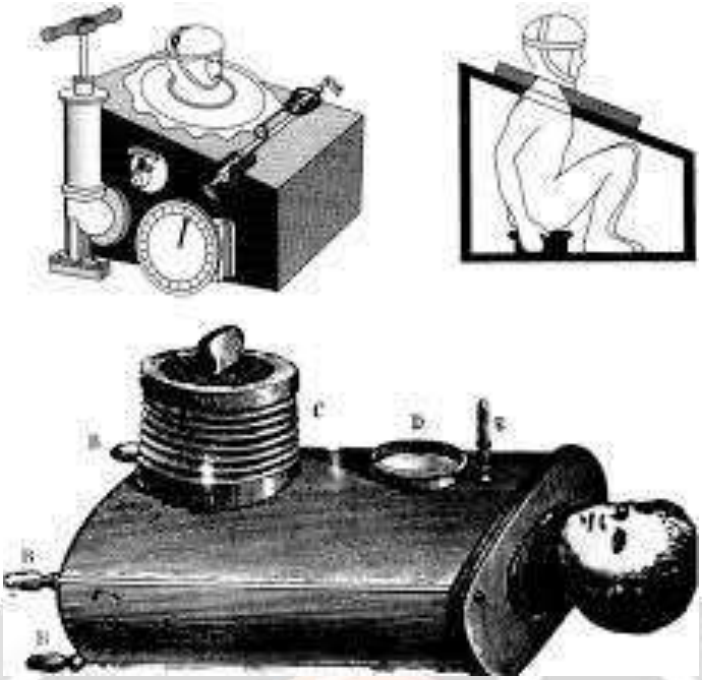

Fig. 2: Tank ventilator

Ferdinand Sauerbruch developed a negative pressure operating chamber named as Sauerbruch chamber in 1904, during this chamber the patient's body, except the top, was maintained inside the chamber. The chamber was large enough in order that the doctor was also ready to lookout of patient inside the chamber. The patient's lower body was protected during a flexible sack in order that positive pressure might be applied to the present part only to stimulate breathing.

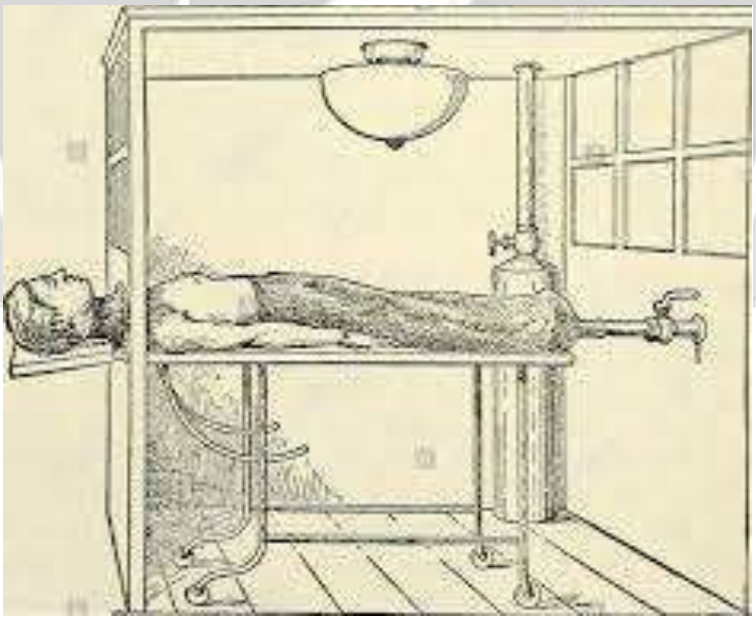

Fig. 3: Sauerbruch chamber in 1904

Negative pressure ventilator becomes familiar after the event of the respirator, which is meant by Drinker and Shaw, and made by Emerson in 1928. It's also a closed chamber almost like sauerbruch chamber, but it had been powered by an electrical motor with air pumps from two vacuum cleaners. The air pumps changed the pressure inside an oblong, airtight metal box, engaging air in and out of the lungs. it had been most popularly utilized in the mid-20th century for the treatment of respiratory failure caused by poliomyelitis.

Fig. 4: Iron lung

Advantages:

- Negative pressure ventilator is best for patient of neuromuscular diseases, but normal lung compliance.
- It is effective for patient who unable to tolerate a facial masks due to claustrophobia and any other airway secretions.
- It reduced the airway complications; improve pulmonary parenchyma inflation at reduced pressure.

Disadvantages:

- Negative pressure ventilator does not work well when patient's lung compliance (it is a measure of the lung's ability to shrink and expand) is decreased.
- It also not good if patient's lung resistance is increased (it is opposite of lung compliance).
- In this method physical access to the patient for nursing care may be restricted and, accurate assessment of chest wall movement is difficult.
- The most serious problem with negative pressure ventilator is extra-thoracic upper airway obstruction when the abductors fail to contract tooppose the negative pressure within the trachea generated during the inspiratory cycle of negative pressure ventilator.

POSITIVE-PRESSURE VENTILATION

The military developed a Concept during World War II to deliver oxygen and gas volume to fighter pilots operating at high altitude was incorporated into the design of the modern positive-pressure ventilator. Positive-pressure ventilation replaced the iron lung with the development of safe endotracheal tubes with high-volume, low-pressure cuffs.

Extraordinary use of positive-pressure mechanical ventilation achieved momentum during the polio epidemic in Scandinavia and the United States in the early 1950s.

In Positive-pressure ventilation [5] airway pressure is applied at the patient's airway through an endotracheal or tracheostomy tube. The positive pressure causes the gas to flow into the lungs until the ventilator breath is ended.

The first mechanical apparatus used to provide positive-pressure non-invasive ventilation, a bag and mask manual ventilator, which is developed by Chaussier in 1780. An advanced bellows with a mask was developed in 1887 by Fell, it is operated manually. During artificial ventilation the finger valve was closed during

activation of the bellows to effect inspiration and was opened to permit expiration passively.

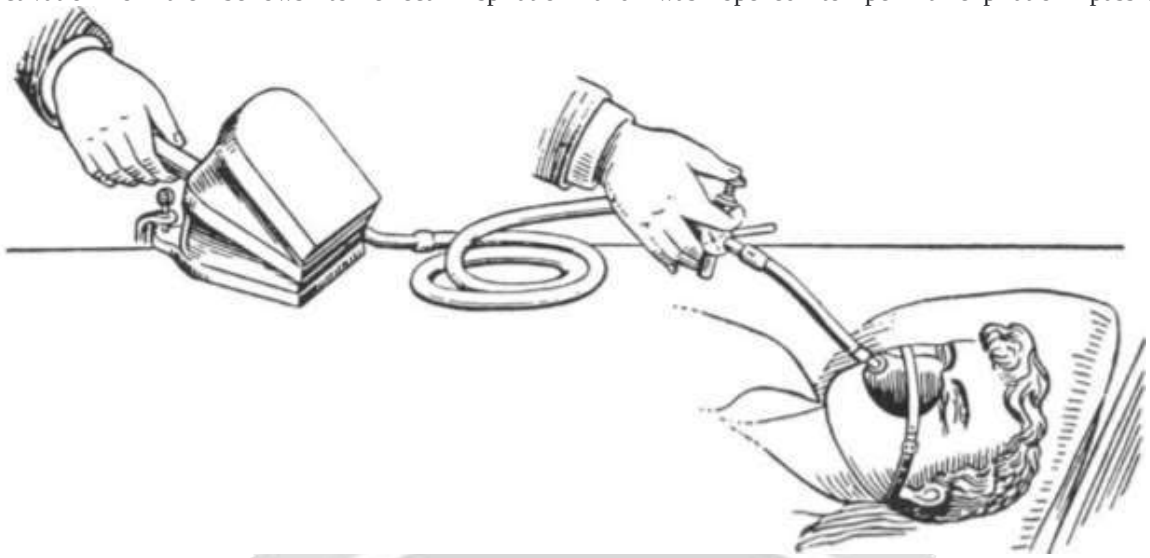

Fig. 5: Manually operated bellows for artificial ventilation

In 1911 Drager's Pulmotor(figure-15) [7] was first introduced. The Pulmotor is a transportable device that transfers oxygen through a face mask until a predefined pressure was reached in the lungs, at the same point exhalation begins. Pulmotor was a pneumatically operated positive-pressure device that has been developed for saving the lives of thousands of people.

Fig. 6: Drager's Pulmotorin 1911

Another approach to providing positive-pressure non-invasive ventilation was developed by Green and Janeway in 1910 named as a "rhythmic inflation apparatus". In this approach patient's head was placed into the apparatus and a seal was secured around the patient's neck with positive pressure applied to the patient's head.

The first Ventilator [5] designed for positive-pressure invasive ventilation was come in the 1940s and 1950s.Thefeature of these early invasive ventilators was that they provided only volume-control ventilation. In the first-generation of intensive care ventilators patient-triggered ventilation was not possible. The tidal volume of Morch ventilator measured with a secondary device and respiratory rate is also counted on the same device. Air was always delivered at an inspiratory/expiratory ratio of 1:2.The Engstrom ventilator is a double-circuit ventilator, could be used as an anaesthesia machine or as an ICU ventilator. It includes monitoring of airway

pressure and tidal volume and allowed more exact setting of respiratory rate, but it provides only machine-triggered inspiration at a 1:2 inspiratory/expiratory ratio.

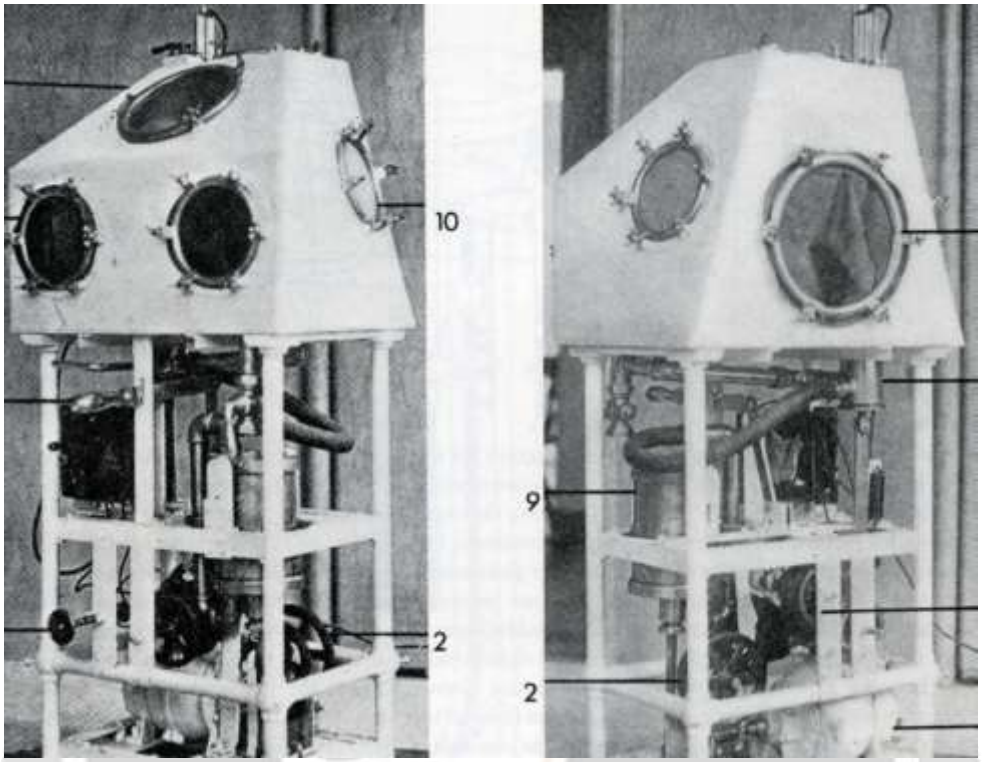

Fig. 7 Green and Janeway rhythmic inflation apparatus, 1910

MECHANISM OF VENTILATOR

Mandatory minute ventilation was purely mechanical; it functions as a closed-loop controller and provides a model for many of the modes of ventilation.

Gas entered in this system at the left and favourably entered in a bellows from which the patient could breathe spontaneously. If the bellows filled completely, gas was directed to a second bellows. Once that bellows filled, gas from the bellows was delivered to the patient as a positive-pressure breath. Dependent on the flow of gas into the system, the setting of the bellows capacity, and the patient's spontaneous minute volume, are set. All breaths may be spontaneous or mandatory or a mix of the two.

The primary problem with this system was that the patient could breathe the entire minute volume with every rapid and shallow breathing pattern, but it provides the first form of closed-loop control.

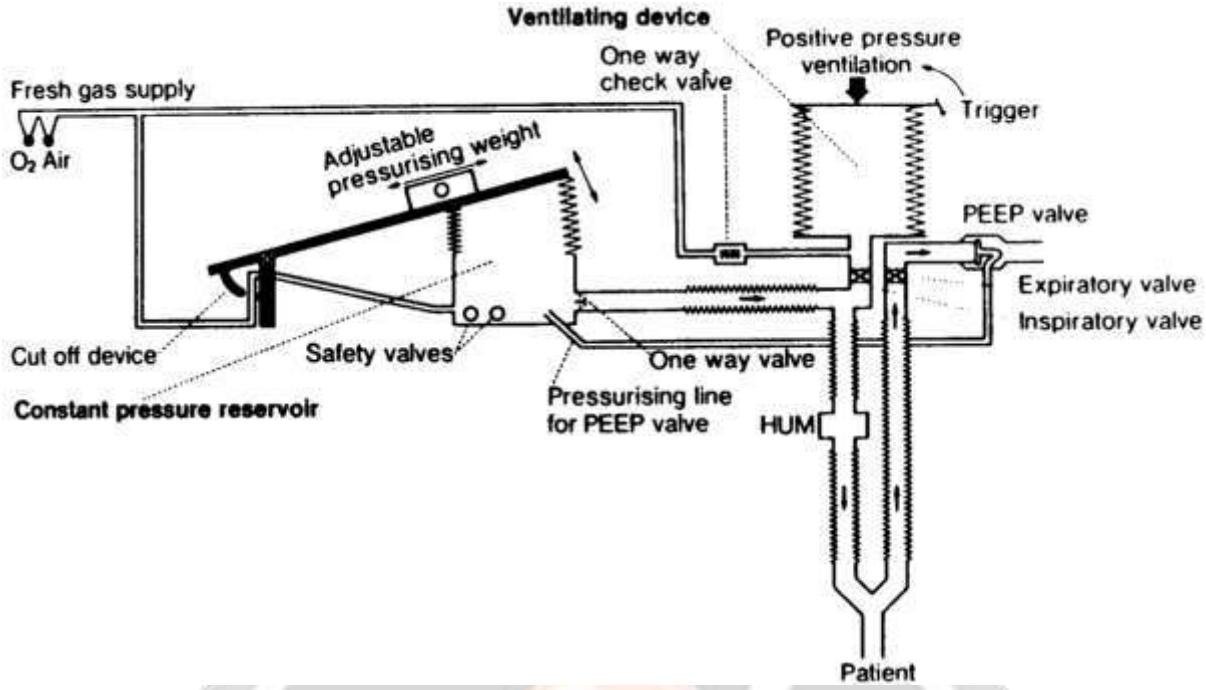

Fig. 7: The first mandatory minute ventilation system

WORKING OF MECHANICAL VENTILATOR

Ventilator is a machine which supports breathing. It's also called a breathing machine or respirator. These machines are mainly used in hospitals. Ventilators will get oxygen into the lungs, remove carbon dioxide from the body, help patient to breathe easier, and breathe for people who have lost all ability to breathe on their own.

Once a ventilation strategy is defined, the ventilator should deliver it to the patient within the most accurate way. To realize this, the machine must sense all variables that outline the breathing pattern with high accuracy and adjust its action in real time. Modern ventilators achieve this by combining cutting-edge technology of actuators, sensors and digital electronics along sides sophisticated processing algorithms.

It is a widely recognised fact that ICU doctors are going to spend much of their working life using ventilators, staring at their screens, making fine adjustments to them, talking about them, and generally appreciating them. One might describe the whole cohort of critical care specialists as the "Mechanical Ventilator Fancier's Society". It is therefore quite remarkable how little attention is paid to the exploration of these apparatus in the expectations of the formal training process.

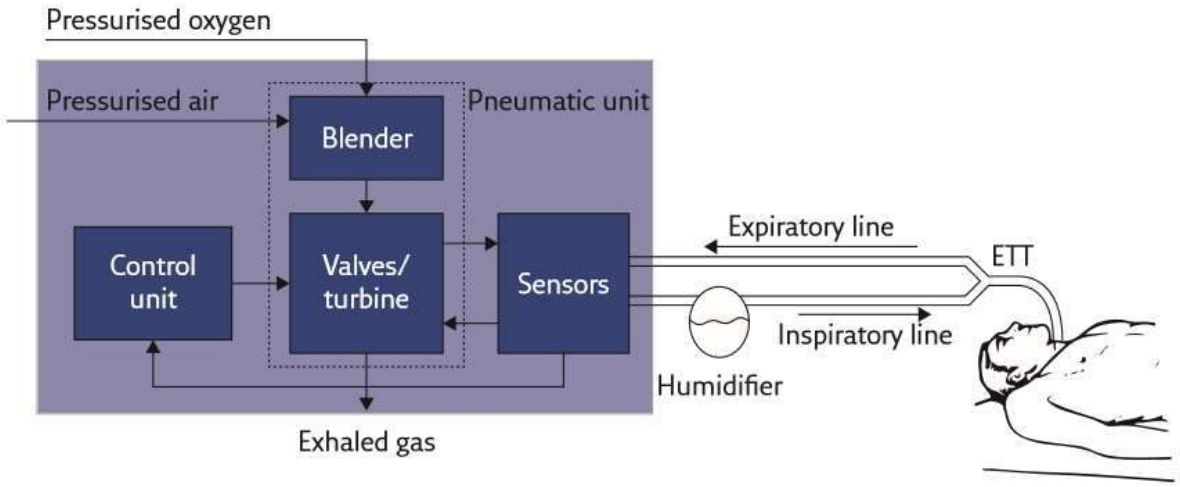

Fig. 8: Basic structure and main functional components of a mechanical ventilator. ETT: endotracheal tube. [8]

MAINTENANCE

Ventilator equipment maintenance includes cleaning, sterilization, adjustment, servicing, and repair. There are two ways of doing this:
1. All maintenance[9] procedures are often performed by a biomedical central service unit responsible of the ventilators of the entire hospital. The principal problem here is that the possible lack of cooperation between the technical and medical staff, resulting in what could be called a "technical desert."
2. Maintenance is often administered between the varied ICUs. The biomedical service centre does only essential repairs, with or without the help of out of doors after-sales service engineers. During this case, maintenance work is out there as long as there's a little specialized team liable for preventive maintenance inside the ICU. Its main responsibilities are to make sure optimal utilization, constant surveillance, detection and correction of minor faults, and instruction of the users.

- Maintain a patent airway. Per policy, note endotracheal (ET) tube position (centi-meters) and ensure that it's secure.
- Assess oxygen saturation, bilateral breath sounds for adequate air movement, and rate of respiration per policy.
- Check vital signs per policy, particularly vital sign after a ventilator setting is modified. Mechanical ventilation increases intrathoracic pressure, which could affect vital sign and flow.
- Assess patient's pain, anxiety and sedation needs and medicate as ordered. Complete bedside check: ensure suction equipment, bag-valve mask and artificial airway are functional and present at bedside. Verify ventilator settings with the prescribed orders.

ADVANCEMENT IN MECHANICAL VENTILATOR

Mechanical ventilation is a cornerstone in the management of patients with acute respiratory distress syndrome (ARDS).Mechanical ventilation can aggravate lung injury, a process referred to as ventilator-induced lung injury (VILI),The pathophysiology of ALI/ARDS presents particular challenges for mechanical ventilation in maintaining adequate gas exchange without causing further lung damage – so-called ventilator-associated lung injury (VALI).Through several mechanisms including volutrauma, barotrauma and bio trauma. Dynamic lung distension and repeated opening and closing of recruit able lung units are considered the two main mechanisms contributing to lung injury.

Preventing acute respiratory distress syndrome ARDS [10]

Early identification of patients in danger for developing acute respiratory distress syndrome (ARDS) and implementation of preventive strategies becomes a crucial approach for critically ill patients admitted to medical care units (ICU), particularly patients receiving mechanical ventilation. ARDS isn't frequently present at the time of visiting the ER or hospital admission and it frequently occurs over a period of hours to days following the clinical insult. Many clinical risk factors are related to the event of ARDS like sepsis, shock, pneumonia, pancreatitis, aspiration, high-risk trauma and surgery, and multiple blood transfusions. An outsized multicentre observation study demonstrated that ARDS develops within a median of two days after hospital admission and also markedly increases in-hospital mortality during this patient population.

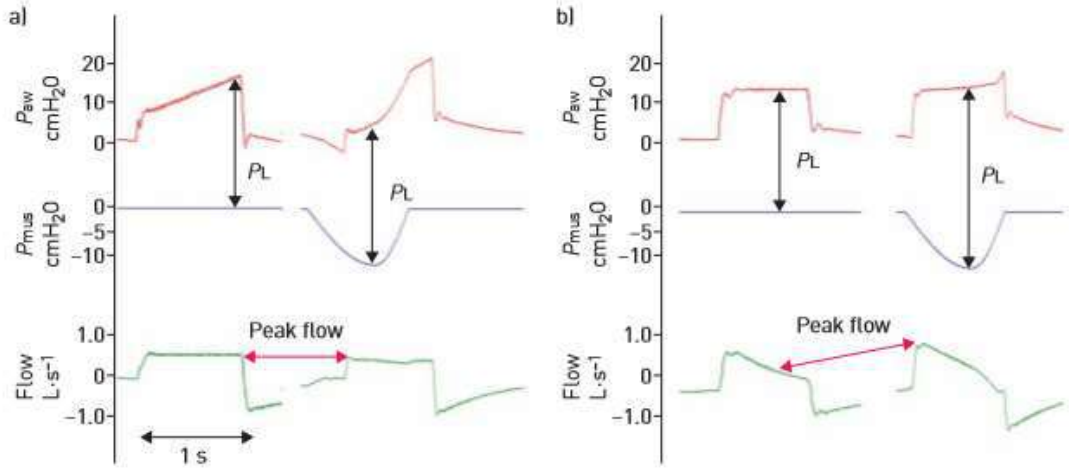

Fig. 9: Change in transpulmonary pressure (PL) from passive to active breathing during a) volume control ventilation (VCV) and b) pressure control ventilation (PCV). By contrast to VCV, with PCV an increasing effort will increase the flow and volume delivered. P_{aw}: airway pressure; P_{mus}: muscular pressure.[10]

Wash-in technique for lung volume measurement

Washout/ wash-in techniques using nitrogen or O2 and CO2 sensors are available in ICU ventilators, which allowing bedside lung volume measurement. The wash-in technique has good correlations with helium dilution or CT scans for EELV measurement. The technique uses a change in FiO2 to permit the calculation of nitrogen washout then wash-in of the aerated lung volume. Although measuring changes in lung volume by itself isn't sufficient to assess recruitment, a comparatively simple method has been described as follows.

FUTURE OF MECHANICAL VENTILATOR

The ICU ventilator of the longer term might not look very different from today, but several features will clearly separate them from the present generation of ventilators. There'll be integration with other bedside technology. Within a couple of years, all ICUs will have electronic charting, where data from all bedside technology are going to be transmitted to electronic documentation systems. As a result, ventilators must be ready to be integrated electronically with all other bedside technology.[11][12]

Protocols will become a part of the essential operation of the ICU ventilator. As more evidence becomes available on how we should always provide lung-protective ventilation, and on how we should always manage specific diseases, ventilators are going to be ready to integrate evidence-based algorithms into their basic operational approach. We should always be setting tidal volume supported the patient's predicted weight. The ventilator of the longer term would require us to input the patient's height and sex, and volumes are going to be presented as mL/kg predicted weight, additionally to absolute volume. The Acute Respiratory Distress Syndrome Network protocol, also as different approaches to performing lung recruitment maneuversand setting PEEP,are going to be selectable options on future ventilators. These approaches will still require the clinician to line basic parameters, but the ventilator will provide guidance to assure that ventilation for a selected disease state is performed within the present best evidence-based guidelines.[5]

Much of the sound pollution within the ICU may be a result of alarms. However, within the overwhelming majority of circumstances the alarms are false. The ventilator of the longer term will correct this. Smart alarms will replace our current systems. for instance, the high-pressure alarm doesn't get to sound whenever pressure exceeds the set level.

The most important thing in new generation of ventilators will do is provide decision support. Each alarm conditions are going to be followed with an inventory of potential causes and potential solutions. Changes in ventilator variables are going to be identified and therefore the clinician notified of the change, the potential causes, and therefore the possible solutions.

Patients who die with ARDS usually die of multiple organ failure, which can be related a minimum of partially to bio trauma. Pharmacogenomics focuses on the role of genetics during a patient's response to drugs and is being used for precision therapy of some drugs, identifying who could benefit and who might be at increased risk of drug side effects. Within the future we could also be ready to identify a genetic basis for risk of bio trauma, a field which may be called Ventilogenomics.

CONCLUSION

It is clear that now the understanding of Mechanical ventilators is developed though the definition of term is still confusing due to various definitions given by different authors in different literatures. Now almost all hospitals and doctors are adopting the concept of mechanical ventilator as the part of their everyday activity due to various constraints by government and foreign partners and it was found to be benefiting entire organization. Ventilators are very essential and important part of any ICUs. The methods we want to monitor compliance are wont to evaluate other computerized protocols at LDS hospital and are reusable within the domain of mechanical ventilation. We found that by monitoring compliance with the protocol, we were ready to detect software and logic errors which will not are detected otherwise. Mechanical ventilation may be a lifesaving and life-sustaining modality which will still evolvemedical technology, pharmacist will still play an important role in rational drug management to optimize pharmacotherapeutic outcomes.

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EFFICIENT USE OF TESTING APPROACHES FOR TRADITIONAL AND OBJECT ORIENTED BASED SOFTWARE PRODUCT

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ABSTRACT

Testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Testing techniques include, the process of executing a program or application with the intent of finding software bugs. Two testing approaches are discussed in this paper namely, traditional and object oriented testing that shows the advantages of one over the other in dealing with complexity, time and cost. The traditional testing approach deals with the projects used in the development of traditional programming like C, while Object Oriented testing approach focuses on the object oriented projects that use the Object oriented programming like C++ & Java. This paper shows the comparison between the testing approaches adopted for traditional and Object oriented system used in software engineering development.

Keywords – *Traditional Approach; Object-Oriented Approach; Software Testing Life Cycle; Comparison between Traditional approach and Object-Oriented approach; Testing approach.*

I. INTRODUCTION

As we all are human beings and human beings commit errors in any process, some of the errors do not impact much on our day to day life and can be ignored; however some errors are so severe that they can break the whole system or software. In such kind of situations you need to take care that such errors are caught well in advance before deploying the system/software in any production environment. This is so that Software testing is an important phase of software development process and it is meant for quality assurance and correctness of the software. The quality assurance of the software is much more dependent on the testing process. The major activities involved in software testing are 1) Generate the test cases, 2) Execute the program using the generated test cases, and 3) Evaluate the test result. Test cases are the basis for testing any software but the approach of deriving the test case may vary upon different software development paradigm such as traditional and object-oriented system.

Later on, I have discussed the rest of the paper in different sections which are organized as follows:
Section II comprises the model designed for testing known as Software testing life cycle or STLC. Section III describes the levels of testing used while conducting software testing. Section IV is sub-divided into three categories that examine the testing approaches applied for the development of traditional software, object-oriented software and finally the comparative study for the testing approaches of traditional and object-oriented software system.

II. SOFTWARE TESTING LIFE CYCLE

Software Testing Life Cycle (STLC) defines the procedure to test or phases in testing of software. It is basically designed with the basics of Software Development Life Cycle (SDLC) which is used to understand the process of building software components and the integration of the system. A systems development project thus goes through a sequence of four fundamental phases: planning, analysis, design, and implementation. It involves basic series of steps at each and every phase of development which are executed consecutively, incrementally, logically or

iteratively [2]. STLC is required after the development to check the functionality and correctness of the system before the deployment of the software to the users.

Thus, the life cycle of software testing is shown in **Fig. 1**. below:

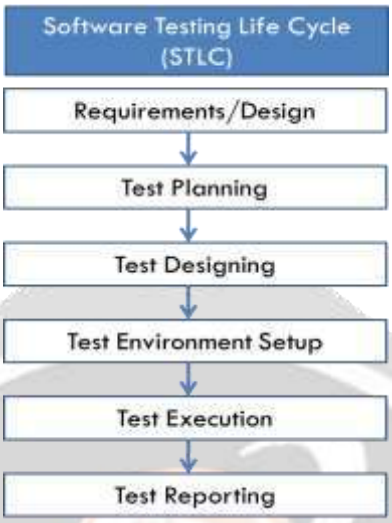

Fig. 1. Software Testing Life Cycle Model

STLC generally comprises of the following phases as discussed below [6]-

Requirements analysis: The first phase of testing is same as in the SDLC used to gather the requirements of the system. In this phase of STLC, testers are supposed to determine what needs to be tested i.e. parameters involved and the design analysis of the system.

Test planning: Planning involves the strategy that must be adopted during the testing of the software. For this testing strategy should be followed, set of test plans must be generated at this level.

Test development: After the plan is generated, some set of test procedures, test scenarios, test cases, test datasets, test scripts should be developed to use in testing software.

Test execution: Execution is carried out on the basis of test plans being conducted and the generated set of test documents. It is required then to report any errors found to the development team.

Test reporting: Once testing is completed, testers generate metrics and make final reports on their test effort and whether or not the tested software is ready for release.

Test result analysis: Or Defect Analysis, is done by the development team usually along with the client, in order to decide what defects should be assigned, fixed, rejected or deferred to be dealt with later.

Test Closure: Once the test meets the exit criteria, the activities such as capturing the key outputs, lessons learned, results, logs, documents related to the project are archived and used as a reference for future projects.

III. LEVELS OF TESTING

Levels of testing include the different methodologies that can be used while conducting Software Testing. Testing is performed at four important levels namely unit testing, integration testing, system testing and acceptance testing as represented in **Fig. 2**.[5] -

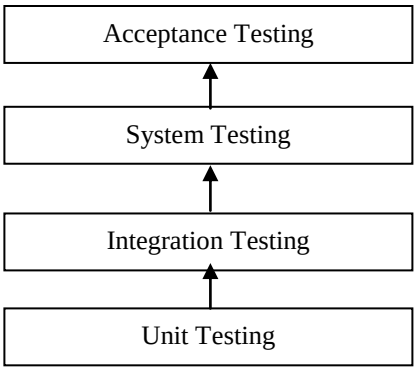

Fig. 2. Levels of SoftwareTesting

A. ***Unit Testing*** is done at the lowest level of software components to ensure the implementation fit the functional specification.

B. ***Integration Testing*** is done to ensure that the tested units interface correctly**.**

C. ***System Testing*** is done to determine if the functionality of the system as a whole is as was specified in the user requirements specification.

D. ***Acceptance Testing*** verifies that the end user(s) is (or is not) satisfied with the system.

IV. SOFTWARE TESTING APPROACHES

Software Testing approaches varied according to the system we chose for the development of the software. Two testing approaches we have adopted namely, Traditional testing approach and Object Oriented testing approach to analyze and compare the software development via traditional and object oriented software. It is stated that Traditional testing tends to emphasize on the algorithmic detail of a module and data that flows across the interface modules whereas, the Object Oriented software tends to emphasize on the operations encapsulated by class and state behavior of the class. Object Oriented features or its concepts like data abstraction, encapsulation, inheritance, polymorphism, message passing, dynamic binding etc. provide functionality to the group of objects for class and the operations associated with it. The impact on testing via. Object oriented software is much higher that cannot be applied over Traditional system software. There arises the need for object-oriented testing techniques which suits for object oriented system.

This is how we illustrated why traditional testing approach cannot be applied for object-oriented software.

A. Traditional Software Development Testing

The phases involved in the traditional software development life cycle are Requirement analysis, Design, Implementation, Testing and Deployment & Maintenance [5]. In this method, the common functionalities are grouped together into separate modules which are further divided into several procedures.

a.) Unit Testing

The goal of unit testing is to isolate each part of the program and show the correctness of individual parts in terms of requirements and functionality.

b.) Integration Testing

The testing of combined parts of an application to determine if they function correctly together is Integration testing. This has been categorized into two methods which are, Top-down Integration testing and Bottom-up Integration testing.

Integration Testing Method:

i. *Top-Down integration* - This testing, the highest-level modules are tested first and progressively lower-level modules are tested after that.

ii. *Bottom-Up integration* - This testing begins with unit testing, followed by tests of progressively higher-level combinations of units called modules or builds.

c.) System Testing

The main objective of the system testing is to ensure whether the software responds perfectly for all possible input conditions and then allowed to handles exception in an acceptable manner. It is to associate and the integration of all the components so that the application is tested as a whole to see that it meets Quality Standards. It represents the overall test on assembled software. System testing also ensures non-functional requirements of the software by conduction of series of tests such as Performance testing, Security testing, Recovery testing, Stress testing etc. [4].

d.) Acceptance Testing

Acceptance testing is concerned with showing that the end product does not meet the user requirement i.e. that the user is not satisfied with the system. Since acceptance testing is based solely on user requirements specs, it is usually the first to receive full planning. It could be carried out by either benchmark testing or pilot testing. The major objective of benchmark testing is to measure the system's performance in the end-user environment. This is usually simulated with the required configuration settings. Pilot testing on the other hand is concerned with installing a system on a user site (or a user simulated environment) for testing against continuous and regular use. Two forms of pilot testing are Alpha Testing and Beta Testing [7].

Alpha Testing is an internal acceptance testing carried out by the test team usually done in preparation for beta testing.

Beta Testing is the system is released to a limited number of people to carry out further tests. Because the system is now in the hands of the public there is no formal methodology for testing.

B. Object Oriented Software Development Testing

a.) Object Oriented Unit Testing

Unit testing refers to tests that verify the functionality of a specific section of code and it is also known as component testing. In an object-oriented environment, concept of class is introduced. So, the testing is done usually at the class level that verifies the functionality and correctness of each section of code using constructors and destructors unit tests. Unit testing also performs data flow analysis, syntax analysis, checks for statement code coverage and other verification analysis.

b.) Object Oriented Integration Testing

Integration testing is performed after unit testing; now the work is to verify the interfaces between components against a software design. In this testing, larger group of tested software components corresponding to elements of the architectural design are integrated and tested until the software works as a system. [6]. Software components may be integrated in an iterative way or altogether. Integration testing works to expose defects in the interfaces and interaction between integrated components or classes (modules).

c.) Object Oriented System Testing

System testing, also known as end-to-end testing, tests a completely integrated system to verify that it meets its requirements. For example, a system test might involve testing a login page of a website, then creating and editing an entry, plus sending or printing results, followed by summary processing or deletion (or archiving) of entries, then logoff. In addition, the software testing should ensure that the program, as well as working as expected. It does not also destroy or partially corrupt its operating environment.

d.) Object Oriented Acceptance Testing

In Object Oriented testing, testing can be conducted in non-hierarchal fashion. It can be done (i.) within an object (ii.) between the clusters of objects that work together (iii.) for the entire system. Acceptance Testing is very user centred and is normally performed by the users in an environment that is just like the deployment environment [6]. It may be performed as part of the hand-off process between any two phases of development. System/acceptance testing techniques are basically the same as in traditional development project.

C. Comparison between Traditional Software and Object Oriented System Software

The traditional approach uses traditional projects that used in development of their procedural programming like C, which leads software developers to focus on decomposition of larger algorithm into smaller ones. The Object-Oriented approach uses to development the object-oriented projects that use the Object oriented programming like C++ and JAVA.

Based on the survey from various literatures comparison is made between the approaches of traditional and object-oriented testing and we found more reasons why testing approach followed in traditional software cannot be applied to object-oriented software.

Difference between traditional testing and object-oriented testing are tabulated below.

TABLE I. COMPARATIVE STUDY BETWEEN TRADITIONAL SOFTWARE AND OBJECT ORIENTED SOFTWARE TESTING.

S.No.	Traditional Testing	Object Oriented Testing
1.	Each and Every module is considered as a Unit that has to be tested.	Class is considered as a unit.
2.	Each module can be isolated and testing is done in similar way.	Since class is a unit, so isolation can not be performed rather as a part of class.
3.	Top down and bottom up integration is possible.	No ordering is to be followed here.
4.	It Follow Hierarchical control structure.	It does not follow hierarchical control structure.
5.	Incremental integration approach is adopted.	No incremental policy involved here.
6.	Used to develop projects that uses traditional programming approach.	Used to develop object oriented projects that uses Object oriented programming.
7.	Uses common approach to test the projects through the phases like: analysis, design, implementation and testing [2].	Uses UML notations like: Usecases, Class diagram, sequence diagram, activity diagram, and deployment diagram etc [2].
8.	Traditional testing is more complex in nature.	Complexity is lower in case of object oriented testing.
9.	Low Cost.	It leads to more Cost.
10.	It depends on the size and type of the projects we want to develop.	Depends on the team experience and their members and project complexity through the members of objects.[2]

V. CONCLUSION

The cost of maintaining software is much more than the cost of producing the software. In order to reduce this maintenance cost, more time and resources is being invested in extensively testing the software before deployment. Software testing is an important phase of software development process and it is meant for quality assurance and correctness of the software. Testing can be performed at various levels such as unit, integration, validation and system. The paper presents the overview of the testing approaches on various development paradigms such as traditional, object-oriented and discusses how testing approach differs with respect to different paradigm. Our paper concludes that irrespective of different software development paradigm, the testing levels (unit, integration, validation and system) but the testing approach concerned to individual paradigm differs widely. It proves that the object

oriented development and testing approaches are best suited to projects that will imply systems using emerging object technologies to construct, manage, and assemble those objects into useful computer applications.

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A Review Paper on Nanomaterial and its application

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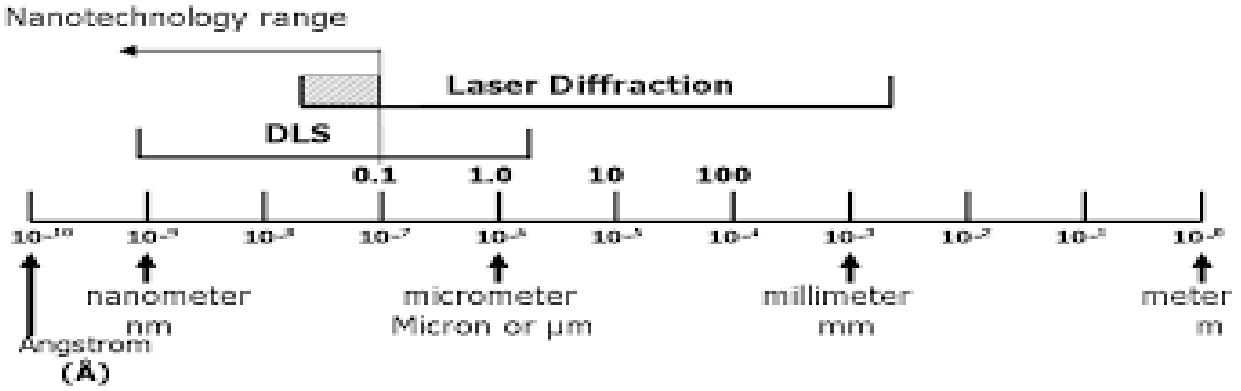
ABSTRACT

Nanotechnology is a groundbreaking road to technical advancement involving nanometer scale material management (one billion times smaller than a meter). Actually nanotechnology means any Nano scale technology that has various real-world applications. Nanotechnology simply involves the manufacture and use of chemical, electrical, and biological systems on scales ranging from individual molecules or atoms to submicron lengths, as well as the incorporation into broader systems of these resulting nanomaterial. It has the power to shift our views and perceptions and give us the opportunity to solve global problems. The disclosure and use of carbon nanomaterial has permitted the presentation of numerous unused regions of innovation in Nano medicine, biosensors, and bioelectronics. In later a long time, nanotechnology has risen as multidisciplinary field, in which picking up a crucial understanding of the electrical, optical, attractive, and mechanical properties of nanostructures guarantees to provide the another era of useful materials with wide-ranging applications. Nanostructures can moreover give arrangements to mechanical and natural challenges within the zones of catalysis, medication, sun powered vitality change, and water treatment.

Keywords; *NANOMATERIAL,NANOSCALE,NANOTECHNOLOGY*

1.Introduction

The prefix nano in the word nanotechnology means a billionth (1*10-9). Nanotechnology deals with various structures of matter having dimensions of the order of a billionth of a meter. While the word nanotechnology is relatively new, the existence of functional devices and structures of nanometer dimensions is not new, and in fact such structures have existed on Earth as long as life itself.

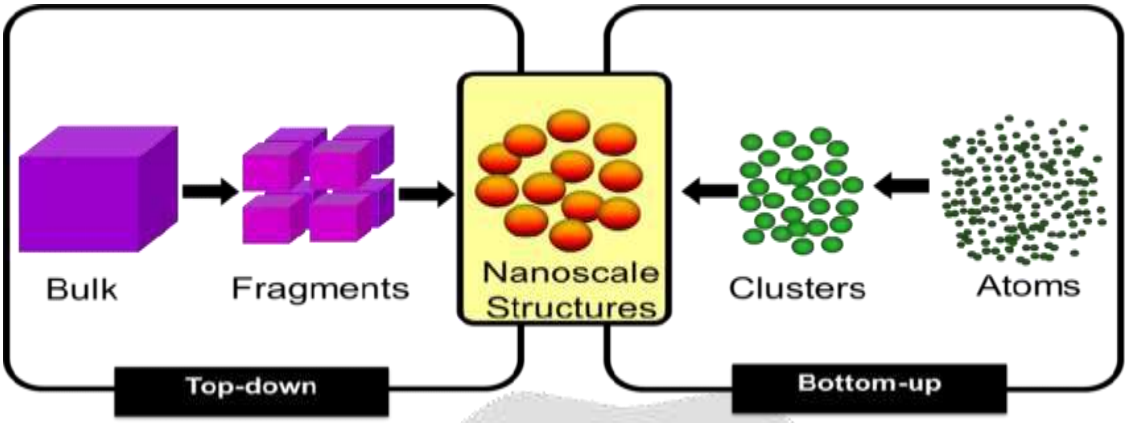


1.1 History of nano technology

It is not clear when humans first began to take advantage of Nano sized materials. It is known that in the fourth-century A.D. Roman glassmakers were fabricating glasses containing Nano size metals. An artifact from this period called the Lycurgus cup resides in the British Museum in London. The cup, which depicts the death of King Lycurgus, is made from soda lime glass containing sliver and gold nanoparticles. The colour of the cup changes from green to a deep red when a light source is placed inside it. The great varieties of beautiful colours of the windows of medieval cathedrals are due to the presence of metal nanoparticles in the glass. The potential importance of clusters was recognized by the Irish-born chemist.Robert Boyle in his Sceptical Chyrnist published in 1661. In it Boyle criticizesAristotle's belief that matter is composed of four elements: earth, fire, water, and air. Instead, he suggests that tiny particles of matter combine in various ways to form what he calls corpuscles. He refers to "minute masses or clusters that were not easily disenable into such particles that composed them." Around 1883 the American inventor George Eastman, who would later found the Kodak Corporation, produced a film consisting of a long paper strip coated with an emulsion containing silver halides. He later developed this into a flexible film that could be rolled, which made photography accessible to many. So technology based on nanosized materials is really not that new Feynman presented his visionary lecture in 1960, there was experimental activity in the 1950s and 1960s on small metal particles. It was not called nanotechnology at that time, and there was not much of it. Reported the first observation of porous silicon in 1956, but it was not until 1990 when room temperature fluorescence was observed in this material that interest grew. Other work in this area involved making alkali metal nanoparticles by vaporizing sodium or potassium metal and then condensing them on cooler materials called substrates. Magnetic fluids called ferrofluids were developed in the 1960s Groups at Bell Laboratories and IBM fabricated the first two-dimensional quantum wells in the early 1970s. They were made by thin-film (epitaxial) growth techniques that build a semiconductor layer one atom at a time. The work was the beginning of the development of the zero-dimensional quantum dot, which is now one of the more mature nanotechnologies with commercial applications the 1980s with the emergence of appropriate methods of fabrication of nanostructures that a notable increase in research activity occurred, and a number of significant developments resulted.In 1981, a method was developed to make metal clusters using a high-powered focused laser to vaporize metals into a hot plasma.1985, this method was used to synthesize the fullerene .In 1991 carbon nanotube discover .In 1993first nano technology lab in us.In 2001 logic gate made by nano tubes.

2. Methods Of Nanoparticle Preparation

Divers methods are employed for the metallic nanoparticles preparation which are categorized into two main types as bottom up methods and top down methods. The principal difference between both the methods is starting material of nanoparticle preparation. Bulk material is used as starting material in top-down methods and particle size is reduced to nanoparticles by different physical, chemical and mechanical processes, whereas atoms or molecules are the starting material in bottom up methods



An overview of top down and bottom up method

2.1 Top Down Methods

In this method bulk material is converted into small nano-sized particles. Preparation of nanoparticles is based on size reduction of starting material by different physical and chemical treatment. It includes methods such as mechanical milling, thermal, and laser ablation. Although top down methods are easy to perform, is not suitable method for preparing informal shaped and very small size particles. The major problem associated with this method is that change in surface chemistry and physicochemical properties of nanoparticles.In this method mostly we use two technic (1) mechanical (2) Laser technic(Laser ablation)

2.2 Bottom Up Methods

Nanoparticle synthesis using bottom up approach is based on formation nanoparticles from smaller molecules like joining of atoms, molecules or small particles. In this method, nanostructured building blocks of the nanoparticles first formed and then assembled to produce final nanoparticle. In this technic we use many method some of them is here

(1) Solid state methods (2) Liquid state synthesis methods (3) Gas phase methods

3. Classification of nanomaterial

Nano material can be classified into various area, generally in nano material are categorized according to their dimensionality, morphology, state, and chemical composition This classification also depends on their size, which ranges from 1–100 nm in at least one dimension. Based on their dimensionality and the overall shape of these materials, NMs can be further divided into four classes. Zero-dimensional nanomaterial(0D) have all their dimensions in Nano scale i.e. sized below 100 nm. 0D includes spherical NMs, cube, Nano rod, polygon, hollow sphere, metal, and core–shell NMs as well as quantum dots (QDs). One-dimensional nanomaterial(1D) are materials with one dimension not in Nano scale while the other two dimensions are in Nano scale. 1D includes metallic, polymeric, ceramic, nanotube, and Nano rod filament or fiber, nanowires, and Nano fibers. Two-dimensional nanomaterial (2D) contain only one dimension in Nano scale while the other two are not. 2D includes single-layered and multi-layered, crystalline or amorphous, thin films, Nano plates, and Nano coating. Three-dimensional (3D) materials

have various dimensions beyond 100 nm. Example some type of nano material are metal nanomaterial, metal oxide nano material, carbon based nanomaterial, semiconductor nano material, ceramic nano material etc.

3.1 Carbon nanotubes

A CNT is a one-atom thick sheet of graphite rolled up into a seamless hollow cylinder with a diameter of the order of one nanometer. CNTs were discovered by Iijima (1991), who first reported the arc-discharge synthesis and characterization of helical microtubules, formed by molecular-scale fibres with structures related to fullerenes. CNTs are characterized by superior mechanical properties when compared with other construction materials. Depending on the radius of the tube, the Young's modulus of a CNT can be as high as 1,000 GPa (Treacy et al. 1996) and the tensile strength can reach 150 GPa (de Heer, 2004). Two different types of CNT exist respectively in the form of single tubes (called single-wall CNTs) and coaxial tubes (multiple-wall CNTs). Multi-wall CNTs are less expensive and easier to produce but exhibit lower strength and stiffness than single-wall CNTs (Bai & Allaoui 2003). Very few studies have been conducted in the area of bituminous binders and mixtures. When CNTs are added with a sufficiently high percentage (> 1%) to base bitumen, they can significantly affect rheological properties (Xiao et al. 2011a; Xiao et al. 2011b; Khattak et al. 2012). Using carbon nanotubes equals to 0.001 of weight bitumen in asphalt mixtures, in addition to improving asphalt pavement properties, will decrease thickness of under layers and as a result reduce stone materials consumption (Motlagh et al. 2012). CNTs provide an enhancement of rutting resistance potential (Amirkhanian et al. 2011a; Amirkhanian et al. 2011b) and of resistance to thermal cracking. Moreover, susceptibility to oxidative aging is reduced with further advantages that are expected in the long-term performance of bituminous mixtures (Santagata et al. 2012).

3.2 Nanosilica

Silica is an abundant compound over the earth that is largely employed in industries to produce silica gels, colloidal silica, fumed silica and so on. The nanosized silicas are interesting particles because they are applied in emerging areas like medicine and drug delivery (Barik et al. 2008). Amorphous nanosilica is qualified as nanobiopesticides. Silica nanoparticles have been used in the industry to reinforce the elastomers as a rheological solute (Chrissafis et al. 2008) and cement concrete mixtures (Quercia & Brouwers, 2010). Silica nanocomposites have been attracting some scientific interest as well. The advantage of these nanomaterials resides in the low cost of production and in the high performance features (Lazzara et al. 2010). With the addition of nanosilica in the base asphalt binder, the viscosity values of nanomodified asphalt binder decreased slightly. Lower viscosity of the binder indicates that a lower compaction temperature or lower energy consumption of the construction process will be achieved. The addition of nanosilica into the control asphalt improved the recovery ability of asphalt binders. The low-temperature grade of nanosilica modified asphalt binder was the same as the control asphalt binder, and the properties and stress relaxation capacity of nanosilica modified asphalt binder was the same as the control asphalt. The anti-aging performance and fatigue cracking performance of nanosilica modified asphalt binder and mixture were enhanced and the rutting resistance and -stripping property of nanosilica modified asphalt mixture were also enhanced significantly. Meanwhile, the addition of nanosilica into the control asphalt binder did not greatly affect the low-temperature properties of asphalt binders and mixtures (Yao et al. 2012b).

The asphalt binder modified by 1% nano powdered rubber VP401 has better performance in resistance to low temperature crack and rutting, compared to other nanomaterial modified asphalt binder (Chen et al. 2012). Spraying TiO2 and ZnO fog to the surface of asphalt slabs show lower aging rates (Steyn 2009;

Gopalakrishnan 2011). The asphalt mixture modified by 5% SBS plus 2% nano-SiO2 powder can increase the physical an mechanical properties of asphalt binder and mixtures (Ghasemia et al 2012). The addition of nanoclay and carbon microfiber would improve a mixture's moisture susceptibility in most cases under water or de-icing chemicals (NaCl, MgCl2 and CaCl2), and even freeze-thaw cycles (Goh, et al 2010).

3.3 Semiconductor nanomaterials

Semiconductor NMs have low bandgap energy of less than 4 eV. Examples of known semiconductors are silicon, germanium, gallium arsenide, and elements near the so-called ''metalloid staircase'' on the periodic table. These NMs are composed of different compounds from various groups, such as II–VI (ZnO), IV (SiO2), and III–V (GaAs). The modification of the structure of these materials into the nanoscale can alter the chemical and physical properties of the materials due to the quantum size effect or by increasing the surface area. The C/ZnO semiconductor, with its high porosity, showed that the high electrical conductivity of the materials depends on the nanostructure formed (Yan et al., 2019). The semiconductor NMs can be divided into two types: (1) intrinsic semiconductors, composed of pure compounds or elements without doping that are present from other metals in the structure. The main characteristic of intrinsic semiconductors is that they have negative temperature coefficients of resistance. This means that by increasing the temperature, the resistivity of the material will decrease and the conductivity will increase; (2) extrinsic semiconductors, which are a type of material added to other metals by doping in its structure, which aims to increase their conductivity, for example, type-n and type-p semiconductors.

4. Properties

4.1 Optical properties

The optical properties of NPs, especially semiconductor materials, are important for several applications, such as photocatalysts and photovoltaics. The optical properties can be determined by basic light principles and the Beer–Lambert law. The increased absorption of wavelengths in semiconductor NPs are influenced by several factors, such as size distribution, shape, sizes, and the type of modifiers. The optical properties of Nd-doped NiO have been studied using UV–Vis spectroscopy (Rahman et al., 2018). Nd-doped NiO NPs could shift to a lower energy value than pure NiO due to the exchange of electrons in the energy band and the localized electron of Nd3+. Optical properties are influenced by the composition of nanostructures, such as metal ion doping and surface modification. Optical properties, especially the reflectance and scattering phenomena, are affected by the particle size of NMs (Piri et al., 2016). The reflectance increases with increasing particle size and decreases by increasing the refractive index. Thus, the particle size can affect scattering particle patterns when exposed to light, resulting in different spectral reflectance (Mikhailov et al., 2018).

4.2 Mechanical properties

NPs have different mechanical properties compared to microparticles or bulk materials. NMs provide a large surface area and are easy to modify, resulting in an increase in mechanical properties such as hardness, adhesion, stress and strain, and the elastic modulus. NPs from a group of inorganic compounds show mechanical properties, while organic compounds generally have low mechanical properties.

Therefore, increasing the mechanical properties of organic compounds is commonly done by the addition of inorganic compounds. Bui et al. investigated the mechanical properties of acrylic polyurethane by the addition of the metal oxide SnO2 (Bui et al., 2020). The presence of SnO2 in the polymer matrix improved the mechanical properties, especially the hardness, impact and abrasion resistance, and adhesion. However, the addition of more metal oxides to the polymer matrix may reduce mechanical properties because the presence of metal oxides can decrease the polymer–polymer interactions, the polymer to metal-oxide interactions, and possible agglomeration processes. Other studies have also reported that mechanical properties depend on the size of the NPs (An et al., 2019).

4.3 Thermal properties

The thermal properties of NPs are better than their fluid form because they have a large surface area and so heat transfers occur directly on the surface of the material. The thermal properties of materials gradually increased by increasing the metal oxide (SiO2) contents added to the polycarbonate (Nomai and Schlarb, 2019). The presence of metal oxides such as SiO2 can increase interactions between NPs and polymers, along with restrictions in polymer chain formation. The addition of a nanofiller, with a high intrinsic thermal conductivity, influenced the thermal properties of NMs (Jeon and Lee, 2019). Overall, the thermal properties of NPs depend on the large surface area, mass concentration, the ratio of energic atoms in NPs, and the fraction of NP volume dispersed.

4.5 Magnetic properties

Magnetic NPs are used for applications in the medical and environmental fields. Magnetic properties are influencedby the particle size of NPs with the best performance showing a particle size of less than 35 nm (Lamouri et al., 2019; Shrimali et al., 2019). In single compound NPs, the magnetic moment value of a molecule is represented directly by the number of magnetic atoms, whereas for multicomponent NPs, the magnetic value is determined by the number of lone pair electrons according to the valence-shell electron-pair repulsion (VSEPR) theory. Generally, the change in particle size is quite small and does not change the lattice parameters of the metals. However, for metals that contain metal oxides on the surface, the lattice parameters of metals may change with changing particle size due to mismatches between the lattice parameters of the metal and the metal oxides, which further causes interfacial stress on the surface. Therefore, the magnetization value will change with the change in particle size. Also, the magnetic properties are influenced by other factors, such as the composition of the nanostructure and the synthesis methods (Lakshmiprasanna et al., 2019; Owens,

2015).

5. Applications of nanotechnology

Nanomedicine is the medical application of nanotechnology.Nanomedicine ranges from the medical applications of nanomaterials and biological devices, to nanoelectronic biosensors, and even possible future applications of molecular nanotechnology such as biological machines. Current problems for nanomedicine involve understanding the issues related to toxicity and environmental impact of nanoscale materials (materials whose structure is on the scale of nanometers, i.e. billionths of a meter.

Functionalities can be added to nanomaterials by interfacing them with biological molecules or structures. The size of nanomaterials is similar to that of most biological molecules and structures; therefore, nanomaterials can be useful for both in vivo and in vitro biomedical research and applications. Thus far, the integration of nanomaterials with biology has led to the development of diagnostic devices, contrast agents, analytical tools, physical therapy applications, and drug delivery vehicles.

5.1 Green nanotechnology

Green nanotechnology refers to the use of nanotechnology to enhance the environmental sustainability of processes producing negative externalities. It also refers to the use of the products of nanotechnology to enhance sustainability. It includes making green nano-products and using nano-products in support of sustainability.

Green nanotechnology has been described as the development of clean technologies, "to minimize potential environmental and human health risks associated with the manufacture and use of nanotechnology products, and to encourage replacement of existing products with new nano-products that are more environmentally friendly throughout their lifecycle.

5.2 Nanoelectronics

Nanoelectronics refers to the use of nanotechnology in electronic components. The term covers a diverse set of devices and materials, with the common characteristic that they are so small that inter-atomic interactions and quantum mechanical properties need to be studied extensively. Some of these candidates include: hybrid molecular/semiconductor electronics, one dimensional nanotubes/nanowires (e.g. silicon nanowires or carbon nanotubes) or advanced molecule electronics. Nanoelectronic devices have critical dimensions with a size range between 1 nm and 100 nm. Recent silicon MOSFET (metal-oxide-semiconductor field-effect transistor, or MOS transistor) technology generations are already within this regime, including nanometer CMOS (complementary MOS) nodes and succeeding 14 nm, 10 nm and 7 nm FinFET (fin field-effect transistor) generations. Nanoelectronics are sometimes considered as disruptive technology because present candidates are significantly different from traditional transistors.

6. Conclusions And Future Prospects

There are several types of NMs with different dimensionalities (0D, 1D, 2D, 3D), morphologies, states, and chemical compositions, which play key roles in their properties. The selection of the synthesis method and the functionalization, modification, or unique configurations of covenant or noncovalent interactions directly affect the characteristics of the NMs produced. Controlling the synthesis or modification conditions, such as reaction temperature, solvents, and surfactants, is crucial to obtaining the required characteristics of NMs toward targeted applications. At present, synthesis methods for NPs, such as sol–gel nanofabrication and hydrothermal methods, are widely used. However, some recent research has been developed using green synthesis approaches, such as using plant extracts (Jayarambabu et al., 2020). The use of NPs still needs to be considered because the material has a toxic effect in specific conditions, especially when nanoparticles transform into other species. The toxicity of anthropogenic and engineered NMs may have a close relationship with some physicochemical properties, such as size, chemical composition, crystal structure, surface morphology, surface charge and energy, and agglomeration state. Therefore, NPs with no toxicity and more environmentally
friendly properties still need to be developed. Furthermore, conditions of synthesis, processing, chemical composition, and dosages are also factors that affect the degrees of risk. Thus, specific studies related to the relationship of physicochemical properties with the toxicity of nanoparticles still need to be developed in the future. Conditions of synthesis, processing, chemical composition and dosages are factors among

others affecting degrees of risk. NMs interactions with biological systems may differ from larger particles since the physical and chemical characteristics of NMs are dependent on size and shape.

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