IOT Used in Nanotechnology and its Application

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Abstract:

Nanotechnology is the basic solution of numerous applications. It deals with the engineering of systems at the atomic and molecular level. It combines components of molecular chemistry and physics with engineering to gain an advantage over the unique changes to the properties of materials that occur at a nano scale. Nanotechnology provides intelligent solutions in diverse areas such as biomedical, industrial and military fields, along with consumer and industrial goods. It can be combined with the IoT to develop a physical network, composed of nano materials that facilitate the exchange of data through various components communicating with each other at the nano level. Their integration, called the Internet of Nona-Things, has already revolutionized the field of medicine, energy and many other sectors as well as taken them to a whole new dimension. It is the very use in all aspect of our community including healthcare, smart cities, military, agriculture and industry[1]. The IoT involves a large number of nano sensors that used to provide more precise and detailed information about a particular object to enable a better understanding of object behavior this paper, how will be use nanotechnology in the future and with help, how can we solve the problem in less time .After that we can make it better by moving forward . An overview of the first is an introduction. This is followed by discussion Application, benefits, methodology, conclusion and reference. In the end, since security is considered to be one of the main issues of the IoT system, we provide an in-depth discussion on security goals.In this project we are try to connect IoT with nanotechnology to make a better work for peoples and society. We work to increase performance of nanotechnology using IoT and try to make a high secure and accurate performance of nanotechnology using IoT[3].

Keyword: IoT, Nanotechnology, sensors, Nanomaterials, Applications

Introduction:

Nanotechnology is powerful. It is the very highly increase day by day in life.It is the wireless telecommunication technique. Iot has the very capacity in connected the using wired and wireless network.IoT concept was first introduced by Kevin Ashton in 1999 . Due to the rapid development in mobile communication, Wireless. IoT (Internet of Things) and nanotechnology are two rapidly growing fields that are now being combined to create innovative applications[2]. IoT is a network of physical devices, vehicles, home appliances, and other objects that are embedded with sensors, software, and network connectivity, enabling them to collect and exchange data. Nanotechnology, on the other hand, is the science of manipulating matter at the nanoscale, which is 1 to 100 nanometers in size. Combining IoT and nanotechnology can create a range of applications with advanced functionalities. Here are some examples of how IoT is being used in nanotechnology and its applications. the combination of IoT and nanotechnology has the potential to create a range of advanced applications with improved

functionalities, including smart sensors, smart coatings, smart packaging, medical diagnostics, and energy harvesting. There is some applications where Iot and nanotechnology works to make a better performance and provide accurate results in minimum time like smart sensors, Energy harvesting, Medical diagnostics and treatment, Smart packaging, Smart coating, Environmental monitoring, Agriculture and so on[3].

Importance of combining IoT and Nanotechnology :-

The combination of the the IoT an nanotechnology has the possible unused quality to completely change many points of view of our is living, from health care to making to conditions looking at. Here are a few Reasons why this combination is important[4,5]:

1. Improved Sensor Technology:

Nanotechnology can make able the work of art of ultra small sensors that can be fixed in every day things, letting them to keep in order, under control and send facts about their general condition. By grouping together these sensors with IoT apparatuses, we can make come into existence a network of connected of apparatuses that can computer viewing output everything from air quality to water levels to the to do with structure true, good nature of buildings[4,5].

2. Enhanced Energy Efficiency: -

By getting mixed together nanotechnology with IoT, we can make come into existence more good at using power apparatuses. For example, by using nanoscale materials to make come into existence more good at producing an effect of electric units or by using sensors to make the most out of power for a given time use in buildings and starting place[4,5].

3. Advanced Medical Applications:

The mix of IoT and nanotechnology 2can be particularly powerful in the field of medical substance. For example, could be used to computer viewing output persons getting care' full of force signs in now, and IoT 1apparatuses could send this news given to health care experts, letting for more timely and working well behaviors[4,5].

4. Smarter Manufacturing: -

By using nanotechnology to make come into existence more increased materials and sensors, we can make come into existence more well dressed making processes. This could lead to getting more out in control, greater doing work well, and made lower, less waste[4,5].

over all, the group of IoT and nanotechnology has the possible unused quality to make great change to many points of view of our is living, making them more good at producing an effect of, able to keep going, and connected. As these technologies go on to undergo growth and get older, we can look to see even more putting in motion applications in the years to come.

Objective of the research paper :-

Nanotechnology the main purpose (had a relation with to workers in general) development and between nations collaboration. with the help of nanotechnology , we can further undergo growth the military and

all useful things supplies. basic operation of making observations given higher position. (basic necessary things needed for a business or society to do operations of) development for taking at front ranking operation of making observations. nanotechnology could also gives power to things to yearly produce energy from their all round, nearby conditions[7]. The earliest, (currently in existence all over a greatly sized area) account of nanotechnology has relation to the one example (had a relation with to knowledge processing machines and science) end, purpose of exactly controlling, misleading smallest units and small complex units for lie, construction of macroscale products, also now said something about to as smallest units nanotechnology. Support the work of art of a complete and complete knowledge base for (process of working out the value, amount, or quality of some thing) of the possible dangers and gets help of nanotechnology to (the state of being healthy of the Earth/the all round, nearby conditions) and to do with man state of being healthy and safety[8].

IoT enabled Nanosensors :-
1. Defination of nanosensors :-
Nanosensors are sensors that use nanotechnology to discover and get at the details of different physical and chemical properties of a sample on a nanoscale level. These sensors can be used to discover and measure a Range of parameters such as temperature, pressure, light, pH, concentration 8 of different chemicals, and bio molecules nanosensors representative form of a sensing element and a transducer, which converts the sensed sign put out into a measurable out-put[7]. because of, in relation to their high sensitivity, specificity , and selection process, nanosensors have a wide range of applications in fields in field such as medical substance, conditions looking at, and food saftey[8].

2. Types of Nanosensors :-
There are various types of nanosensors, each with its own unique characteristics and applications. Here are a few examples[9]:

Carbon nanotube sensors: These sensors are made from carbon nanotubes and can be used to detect various gases, such as carbon monoxide and nitrogen dioxide[9]. Working process given in describe in fig.1
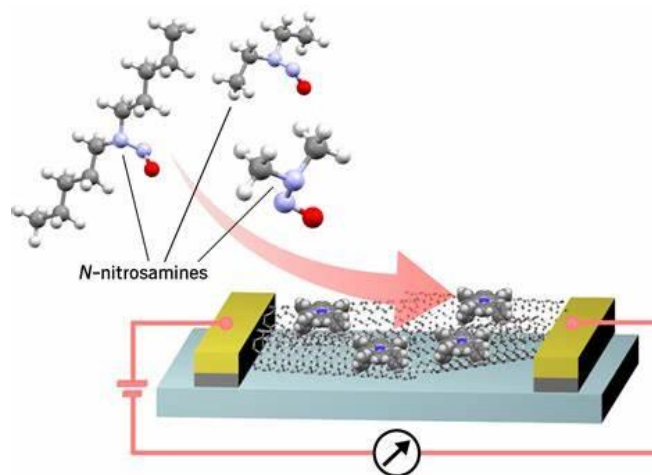

Fig :1. Working Process Carbon nanotube sensor

Quantum dot sensors: These sensors use semiconductor nanocrystals called quantum dots to detect light, and are used in applications such as biological imaging and chemical analysis[9].Working process given in describe in fig.2.
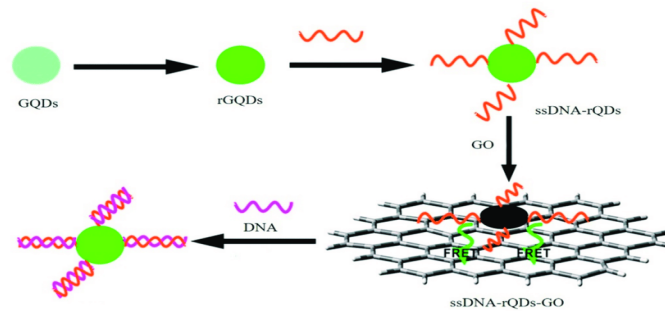

Fig :2. Working Process of Quantum dot sensors

Nanowire sensors: These sensors use tiny wires made from materials such as silicon or zinc oxide to detect changes in temperature, pressure, or other physical or chemical properties[9].Working process given in describe in fig.3.
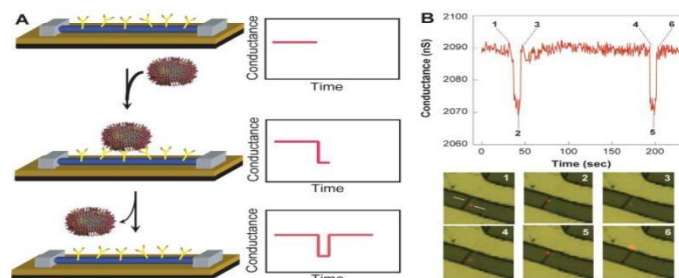

Fig. 3. Working Process of Nanowire sensors

Surface-enhanced Raman scattering (SERS) sensors: These sensors use metallic nanoparticles to enhance the Raman scattering signal of molecules adsorbed on their surface, enabling the detection and identification of trace amounts of molecules[9].Working process iven in describe in fig.4.
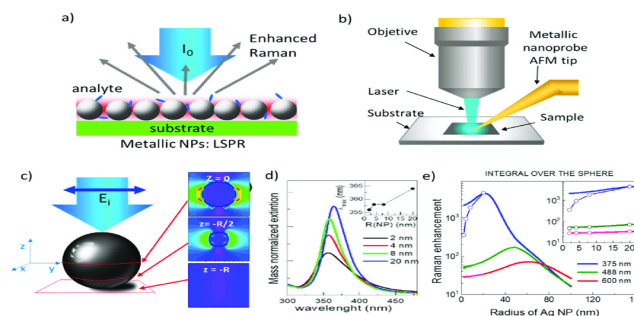

Fig.4.Working of Surface-enhanced Raman scattering sensors

Magnetic nanosensors: These sensors use magnetic nanoparticles to detect changes in magnetic fields, and are used in applications such as biomedical imaging and environmental monitoring.Working process given in describe in fig.5.
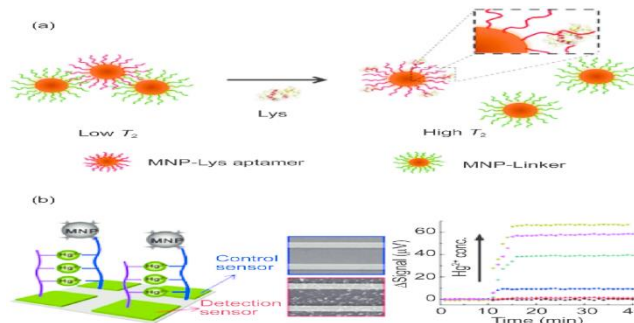

Fig :5.Working Process of Magnetic nanosensors

Electrochemical nanosensors: These sensors use electrodes coated with nanostructured materials to detect changes in electrical signals, and can be used to detect various biomolecules such as glucose and DNA[10].Working process given in describe in fig.6
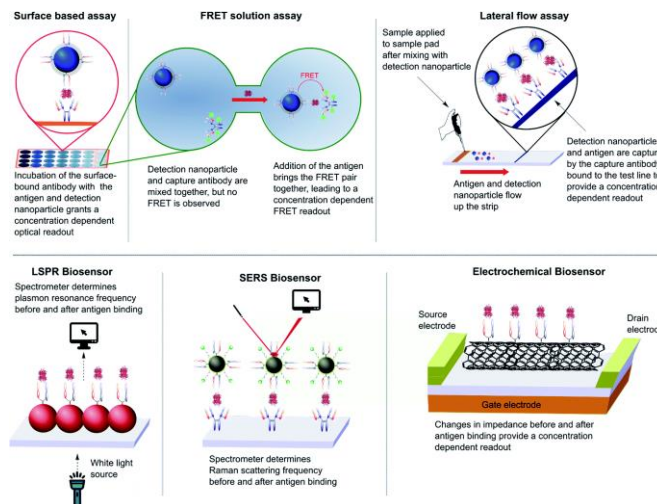

Fig :6. Working Process of Electrochemical nanosensors

Overall, nanosensors have a wide range of applications in fields such as medicine, environmental monitoring, and food safety due to their high sensitivity and selectivity.

3. How IoT can enable Nanosensors :-

The the internet of things (IoT) is a network of connected apparatuses that can keep in touch with each other and exchange facts. The joined as complete unit of nanosensors with IoT can make able a range of new applications and gets help. Here are some examples[11]:

a. Remote sensing and Monitoring :-

Nanosensors can be used to computer viewing output different physical and chemical properties of an example, such as temperature , pressure, and getting-together of different chemicals, and send the facts

to cloud or other apparatuses. This enables at the same time looking at of conditions, which can be useful in different applications such as farming, industry, and health-care[11].

b. Improved data accuracy and reliability: -
nanosensors can make ready high sensitivity and selection process, which can get more out of the act of having no error and level of being ready for working of the facts self-control. In addition, the joined as complete unit with IoT can give power to facts join by heating from number times another sensors , which can give a more in great detail, wide range picture of the general condition being looked at[12].

c. Energy efficiency:
Nanosensors representative use up very little power, which can give power to the development of low-power IoT apparatuses. This can be useful in applications where power for a given time doing work well is full of danger, such as far away, widely different sensing and looking at[12].

d. Predictive maintenance: -
The mix of nanosensors with IoT can make able quality to do with stating before-hand the future of support of necessary things. By looking at different parameters , such as temperature and quick motion, nanosensors can discover signs of damage and make into bits before necessary things becomes feeble, which can get changed to other form down-time and support gives idea of price[12].

e. Nanosensors :
Nanosensors can be fixed in nanomaterials and nanodevices to keep in order, under control facts such as temperature , humidity and pressure and send it through radio to IoT -enabled apparatuses. This can makeable far away, widely different lookin g at of nanomaterials and nanodevices and help in getting more out of their doing a play[13].
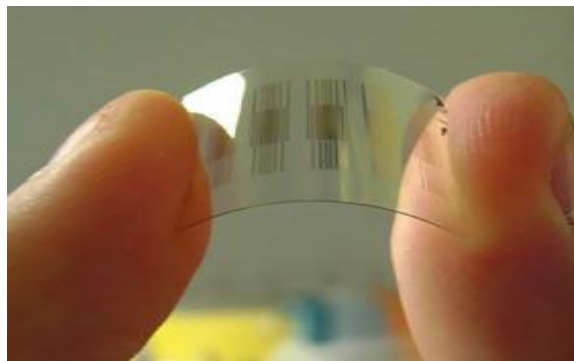

Fig :7. Nanosensors

f. Nanorobots :
Nanorobots are very small machines that can be used for different applications , such as medical substance sometimes used for amusement things taken round to and conditions sensing. By getting mixed together IoT powers into it becomes possible to from far control and computer viewing output their operations , giving power to more right in details and working well use[13].
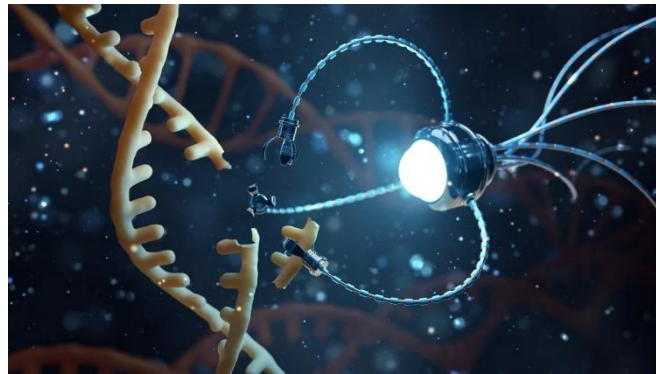
Fig : 8. Nanorobots

g. Nanomaterials with IoT - enabled tops :

Nanomaterials with IoT-enabled tops can be used to make come into existence well-dressed coatings that change their properties in move to out-side things causing reaction. This can be useful in a range of applications, such as a self -cleaning tops and well-dressed windows[11].
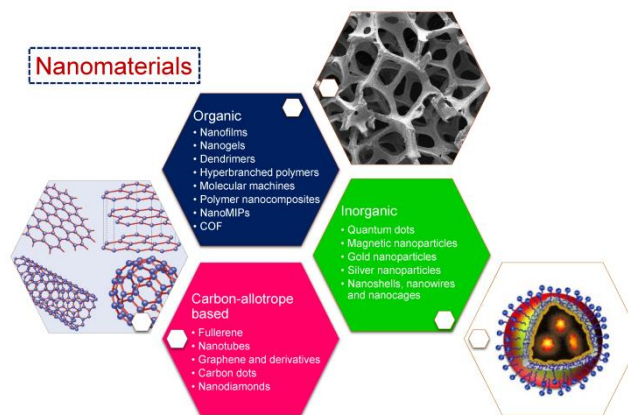

Fig :9. Nanomaterials

h. Edge computing :

IoT apparatuses produce a greatly sized amount of facts , and giving on all of this facts to the cloud for processing can be useless . Egde computing can be used to process facts at the apparatus level, making lower the amount of facts that needs to be sent to the cloud. This can be particularly useful in nanotechnology , where the apparatuses are often small and may have limited processing powers.
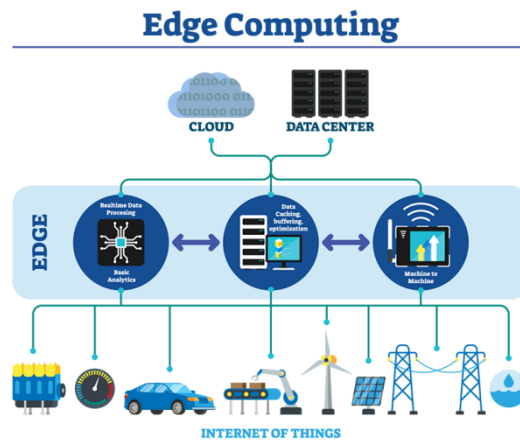
Fig :10. Edge Computing

i. Security and Privacy :

IoT apparatuses are open to attack to safety and right not to be public sings of the danger , and this is particularly true in the example of nanotechnology where the apparatures are often used in sensitive applications. right safety measures must be taken to keep safe the facts self –control by these apparatuses, and right not to be public has a part in must also be worked out.

over-all, the joined as complete unit of nanosensors with IoT can make able a range of new applications and gets help, such as far away, widely different sensing and looking at, got more out of facts act of having no error and level of being ready for working, power for a given time doing work well, and quality to do with stating before-hand the future of support[12].

Applications of IoT and Nanotechnology : -

The combination of the the internet net of things (IoT) and nanotechnology has the possible unused quality to completely change different industries by making able to at the same time looking at, quality to do with stating before-hand the future of support, and data-driven decision-making. Here are some examples of applications of IoT and nanotechnology [2]-

1. Smart cities:

IoT-enabled nanosensors can be used to computer viewing output different parameters in great towns, such as trade goods against the law move liquid-like, air quality, and waste business managers. This can help cities become more able to keep going, good at producing an effect of, and sensitive to persons having rights in the nation' needs[2].

Fig.11. Working of Smart cities

2. Energy management:-

IoT-enabled nanosensors can be used to computer viewing output and control power for a given time use in buildings, giving power to good at using power operations and price amount made less. For example, the company Enlighted has have undergone growth a IoT enabled nanosensor system that can computer viewing output occupancy, temperature , and lighting in buildings to make the most out of power for a given time use[2].
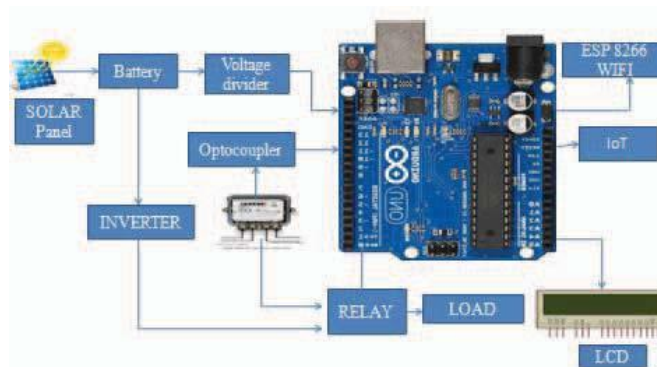

Fig.12. Working of Energy management

3. Agriculture:-

IoT sensors and nanotechnology can be used to watch (for changes, unusual things, etc. Crop growth and soil conditions, improving (as much as possible) crop-watering/rinsing with water and (the adding of things to soil to make plants grow better). Nanoparticles can also be used to improve the something that acts as food uptake of plants, improving crops IoT-enabled nanosensors can be used to computer viewing output earth wet, acting as food levels, and other conditions factors in short haircut, making able to farmers to make the most out of watering system and act of making fertile and increase short haircut gives in[4].
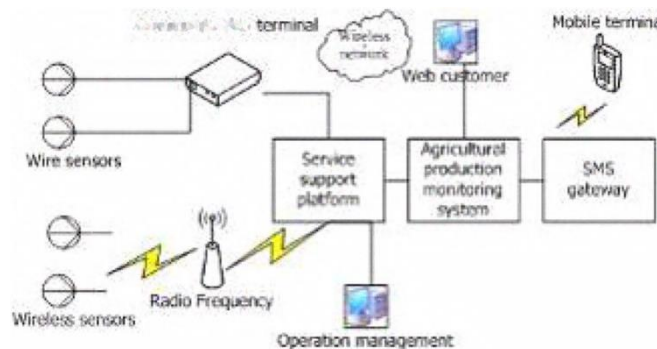

Fig.13. Working Process of Agriculture

4. Healthcare:-

Nanotechnology-based sensors can be used in health-care applications such as far away, widely different unprotesting looking at, drug delivery, and disease diagnosis . IoT can make able the getting together and observations of facts from these sensors , giving power to made for a person and data-driven health-care.There is some examples like Nanotech detectors for heart attack . Nanochips to check plaque in arteries.Nanocarriers for eye surgery, chemotherapy etc. Diabetic pads for regulating blood sugar levels.NanoFlares are used for detection of cancer cells in the bloodstream.Nanopores are used in

making DNA sequencing more efficient[5].IoT enabled nanosensors can be used to watch (for changes, unusual things, etc.) the health of patients in (happening or viewable immediately, without any delay), detecting and (identifying a disease or its cause sickness at an early stage. Nano particals can also be used for targeted drug delivery to clearly started / particular cells or tissues, reducing side effects and improving effectiveness[6] .
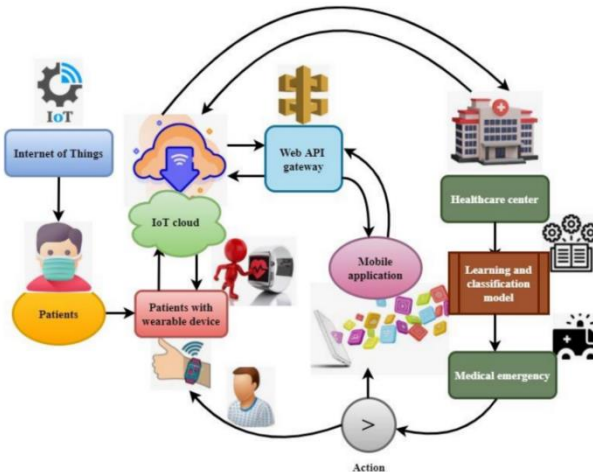

Fig.14. Working of Healthcare

5.   Industrial monitoring:-

IoT-enabled nanosensors can be used to computer viewing output different parameters in to do with industry necessary things, such as temperature , pressure, and vibration, making able to quality to do with stating before-hand the future of support and making price lower down time. ToT sesnsors can be combined different things together so they worked as one with nano materials to create smart packaging that can detect and communicate. Information about the contents of the package, such as temperature, information about the contents of the package, such as temperature, humidity , and freshness . This can be especially useful for food and drug-based products that require strict temperature control[6].
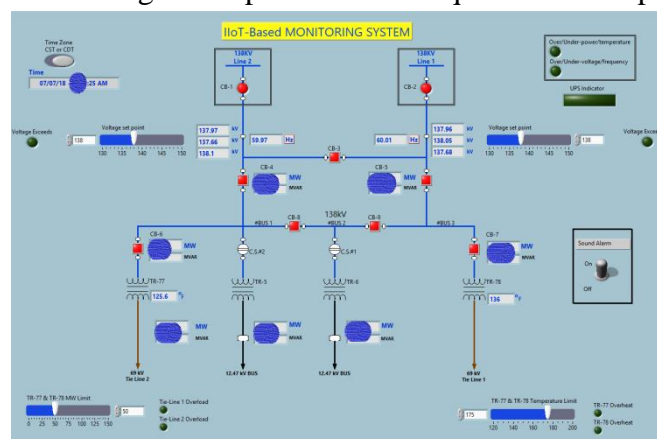

Fig.15.Working of industrial monitoring

6.   Smart-coating

Nanotechnology can be used to create smart coatings that can respond to changes in the health of the Earth/the surrounding conditions, such as temperature, light, and humidity. By combining IoT

sensors with these coatings , they can become even smarter , allowing them to communicate with other devices and trigger actions based on their readings[6]

7. Military:-

Military use the nanotechnology and show the result is the best. The war strategy has changed with theexistence of new advanced biological and chemical weapons that make the difference in any battle. In the military. In addition,   nanosensors have the capability t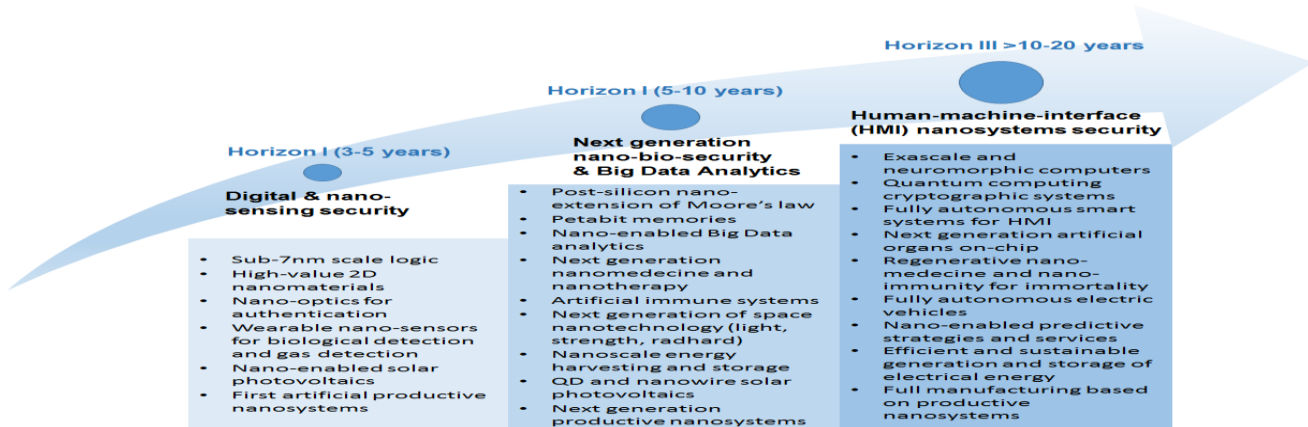o identify the problems of very small cracks[7]   .

Fig.16. Roadmap to maintain Military Security

8. Environmental Monitoring:

IoT sensors can be used to watch (for changes, uncommon things, and   so on.) the quality of air, water, and earth in (event or viewable straight away, without any loss (waste) of time). nanotechnology can make ready (made much smaller) and highly sensitive sensors to discover and put into numbers (things that dirty the air, great   sized   seas, and   so on.) and other contaminants at very low strong   amount. Nanosensors can be used to look at air quality, water quality, and other conditions parameters . IoT can make   able the getting together and observations of facts from these sensors , giving   power   to at   the   same   time looking at and business managers of conditions chances[8].
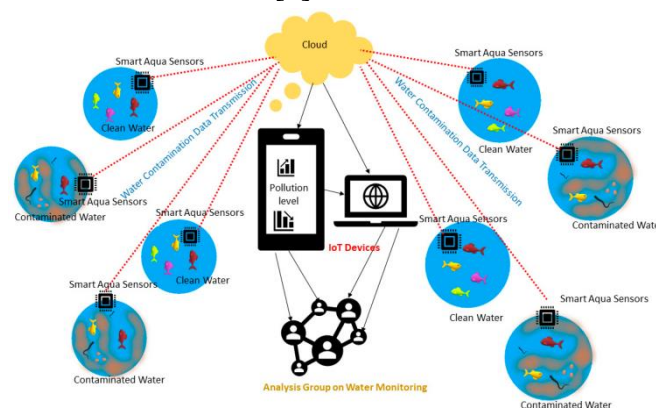

Fig.17.Working of Environmental Monitoring

over-all, the mix ofIoT and nanotechnology 2 has the possible unused quality to make great change to different industries by making able to at the same time looking at, quality to do with stating before-hand the future of support, and data-driven decision-making.

Challenges and opportunities :-
Challenges of using IoT - enabled nanosensors

IoNT is carefully thought about/believed to be the most (made much smaller) of networks that have very great possible power to be took up in (event or viewable straight away, without any loss (waste) of time . Although the IoNT gives unlimited gets help, it have pain, troubles some questions that need to be put one's hands on to give power to the IoNT to be a greatly important part/section of persons in general in the near future without any limits. This part gives a short account of the most common questions of the IoNT[9].

a. Data Analysis:

Current sensor networkskeep in order, under control facts using a noise in back tree in which each net work point senses the (things that are near and around some thing), gets in order, under control (clearly connected or had a relation with) facts and then authorities in writing itto the go down net work point in the tree. In IoNT picture/situation, there are a greatly sized number of connected to the microgateway which can outcome in an important about related to fact s trade goods against the law[9].

b. Radio Frequency and Channel capacity:-

I clearly, the need for more facts grows every day, so that more radio frequency/ ability is needed. however, the ready (to be used) radio frequency/ ability is limited. This questioning can be talked to/looked at by changing to (not used for a purpose/not cruelly made wrong use of bands of the storyof to electrics producing magnetic 1 fields) band such as the terahertz band. The terahertz band pro vides a very great amount of radio frequency/ability for very short ranges. as an outcome of that, a greatly sized amount of narrow way power (to place in ship for goods or do some-thing. thing) will be (simple, not hard to get to, use, or get through knowledge for nanonetworks however, nanomachines are simple apparatuses with limited powers, so using the complete work narrow way (in a way that produces a great amount with every little waste by these nanomachanics is not a simple regular work which will need more (act of making a request questions and attempting to discover the truth about some-thing)[10].

c. MAC Rules of conduct for Nanomachines:

Nanomachines transmit the information from the source to the destination using very short pulses. Nano networks cannot use Medium Access Rules of conduct (MAC) for carrier sensing based a communication. This is because no carrier signal is used for sensing. Therefore, new MAC rules of conduct need to be (examined closely so the truth can be found) for pulse based transmissions of nanonetworks . Nanomachines are simple devices with limited abilities so the new rules of conduct should not be very complicated. The information is brought across through very short pulses which decreases the chance of crashes between different nanonodes trying to access the channel a

t the same time. Also, new MAC rules of conduct should be designed to give maximum (the ability to be made bigger or smaller), throughput, and fairness for nanomachines[10].

Opportunities of combining IoT and Nanotechnology :-

The development of new technologies such as nanotechnology brings both possible benefits and risks. While there are many opportunities to create new and interesting solutions using nanotechnology, it is important to carefully think about/believe and address the possible risks that may arise. As with any new technology, there may be unintended results that could have bad effects on human health or the health of the Earth/the surrounding conditions.Overall, while nanotechnology holds great promise for dealing with worldwide challenges, it is important to approach its development with caution and to put in order of importance the test/evaluation and lessening (something bad) of possible risks in order to secure/make sure of an (able to last/helping the planet) future[11].

Methodology for how to work IoT in nanotechnology :-

The joined as complete unit of the net of things (IoT) with nanotechnology can make able at the same time looking at, control, and making the most out of nanoscale systems. Here is a general methodology for using IoT in nanotechnology [12]:

Sensor Development:

Nanosensors are designed and made to discover and measure physical, chemical, and biological paramet ers at the nanoscale. These sensors 8 can be highly sensitive and special, making ready at the same time data on a wide range of parameters[12] .

Sensor Integration:-

The nanosensors are got mixed together with Iot apparatuses such as openings, routers, or edge apparatuses. These apparatuses act as a bridge between the nanosensors and cloud-based supports[12].

Data Acquisition:

The nanosensors are got mixed together with Iot apparatuses such as openings, routers, or edge apparatuses. These apparatuses act as a bridge between the nanosensors and cloud-based supports[12].

Data Processing:

The data self-control by IoT apparatuses is processed using AI algorithms and ML copies made to scale. These algorithms and models help to get out knowledge and make out designs in the data [12]

Data Analytics:

The processed data is got broken up (into simpler parts) and viewed in the mind using different apparatus for making or put right things such as instrument boards and maps. This helps to make well-detailed decisions based on the knowledge got from the data .

Actuation:

It is based on the knowledge got from the data analytics , actions can be taken in at the same time to make the most out of the operation of the nanotechnology systems. This can have to do with adjusting parameters such as temperature, pressure, or chemical make-up[11].

Feedback loop:

The results of the actuation are got food to back into the system , which can then adjust the sensors, apparatuses, and parameters in at the same time to get done better doing a play.

over-all, the joined as complete unit of IoT with nanotechnology provides a powerful operating system for undergoing growth increased materials, sensors, and apparatuses that can make great change to different industries. The methodology out lined above can help to guide the development and placing of IoT-enabled nanoscale systems[9].

Case studies of successful implementation of IoT in Nanotechnology :-

There are several examples of with a good outcome putting into effect of IoT in nanotechnology that have resulted in important moves-forward in different industries. persons making observations have have undergone growth an useable biosensor based on nanotechnology and IoT for continuous looking at of biochemical markers in work wet drops on skin. The biosensor is chiefly of a work wet drops on skin group apparatus, a readily bent nanosensor order for sensing different analytes, and a radio IoT operating system for data 8 getting together and sending (power and so on)[6]. The biosensor has made clear hoping results in sensing glucose, lactate , and pH levels, which can be used for at the same time looking at of state of being healthy conditions such as diabetes and sports-able doing a play. IoT-enabled nanosensors have been got mixed together into making processes to get more out of quality control and doing work well[7]. For example, nanosensors can be fixed in into materials such as common building material to computer viewing output the drying and salting process and make ready at the same time take-back on temperature and wet levels. This can help to make the most out of the drying and salting process and make certain that the last product has meeting with the needed details as to how things are to be done.persons making observations have have undergone growth a new sort of apparatus for producing electric current based on nanotechnology and IoT for power for a given time place for storing. The apparatus for producing electric current is chiefly of a nanostructured electrode material and a IoT-enabled looking at system that can discover and make the most out of the putting payment through and sending out wheeled machines. This has led to an important getting more out in the apparatus for producing electric current's operation, including higher power for a given time relation between mass and size and longer living time from end to end[8]. IoT-enabled nanosensors have been have undergone growth for at the same time looking at of water quality. The nanosensors can discover different pollutants such as weighty metals and necessary part of a system compounds , and send the data through radio to an IoT operating system for analysis and picture. This can help to make out and make good starting points of unclean, diseased things and get more out of water quality.over-all, the with a good outcome putting into effect of IoT in nanotechnology has resulted in important moves-forward in different industries, including health-care, making, power for a given time, and conditions looking at. These example studies put examples on view of the potential of IoT-enabled nanosensors for now looking at, control, and making the most out of nanoscale systems[9].

Future Scope :-

Nanotechnology could also make able objects to yearly produce energy from their all round, nearby conditions . New nano-materials and ideas are now being have undergone growth that event (possible state of of/possible event of) producing energy from motion, light, differences/different versions in temperature , glucose and other sources with high (changing from one form, state , or state of mind to another) (wasting very little while working or producing some-thing)[6].Give a higher position to the design and development of safe and with conditionsbenign making and death processes for designed and made and nanotechnology enabled products. Nanotechnology has a sizeable range of possible unused quality applications and is had in mind to have an important force of meeting blow on different industries in the future. Some possible unused quality future scopes of nanotechnology can be used undergo growth having a tendency to the new give substance having effect upon the senses things taken round to systems, selected cancer therapies, and diagnostic apparatus for making or put right things with high act of having no error and specificity[7]. nanotechnology can be used to undergo growth highly good at producing an effect of solar units, advanced electric units, and powering material, substance units that are more able to keep going and good-price.nanotechnology can be used to make come into existence smaller and more good at producing an effect of electronics, including transistors memory apparatuses. It can also lead to the development of new materials and technologies for quantmc omputing.nanotechnologycan be used to undergo growth fiction story materials and processes for water clean making air filtration and waste process, leading to cleaner and more able to keep going conditions nanotechnology can be used to undergo growth increased sensors, smart fertilizers, and working without error farming apparatus for making or put right things, leading to more good at producing an effect of and able to keep going farming experiences. Nanotechnology can be used to under going farming experiences. nanotechnology can be used to undergo growthhigh-performance and well-dressed textiles that are strong, water-repellent and antimicrobial.over-all, the possible unused quality future scopes of nanotechnology are sizeable, and this field is had in mind to have an important force of meeting blow on different industries, leading to the development of having a tendency to the new products and answers with gave greater value to doing a play, doing work well, and ongoing power[11].

Conclusion :-

The joined as complete unit of IoTand nanotechnologyoffers great possible unused quality for different industries. This technology can lead to more good at producing an effect of and able to keep going experiences, get more out of person getting care outcomes, and get changed to other form gives idea of price. however, working out the questions connected with this technology is turning point to getting money for its full possible unused quality. Further operation of making observations and development are needed to over-come these questions and take more

chances of the chances offered by IoT-enabled nanotechnology .The combination of IoT and nanotechnology can create numerous possibilities in various fields. IoT can provide real-time data that can be used to improve the efficiency and effectiveness of nanotechnology. The development of nanosensors that can operate in harsh environments and the integration of nanosensors into existing infrastructure are some of the challenges that need to be addressed. In the future, the integration of IoT and nanotechnology can lead to the development of smart. In conclusion, the integration of IoT and nanotechnology has the potential to revolutionize many areas, including healthcare, manufacturing,

energy, and agriculture. The use of IoT in nanoscale manufacturing, sensing, and energy harvesting has already shown promise, but there are also challenges that must be addressed. Further research is needed to overcome these challenges and fully realize the potential of this integration[6,7,8].

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