MICROSPECTRA SOFTWARE TECHNOLOGIES PVT.LTD.

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CASE STUDY

Obective: To understand Future Emerging Computing and need of Society Implementation application.

Areas: Hopitlity, Agriculture Industry, Real Estate, Education etc.

1. To study Artificial Intelligence its Need and Application in various domain.

➢ Artificial Intelligence:

Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing (NLP), speech recognition and machine vision.

➢ Four types of Artificial Intelligence:

Arend Hintze, an assistant professor of integrative biology and computer science and engineering at Michigan State University, explained in a 2016 article that AI can be categorized into four types, beginning with the task-specific intelligent systems in wide use today and progressing to sentient systems, which do not yet exist. The categories are as follows:

- **Type 1: Reactive machines:** These AI systems have no memory and are task specific. An example is Deep Blue, the <u>IBM</u> chess program that beat Garry Kasparov in the 1990s. Deep Blue can identify pieces on the chessboard and make predictions, but because it has no memory, it cannot use past experiences to inform future ones.

- **Type 2: Limited memory:** These AI systems have memory, so they can use past experiences to inform future decisions. Some of the decision-making functions in <u>self-driving cars</u> are designed this way.

- **Type 3: Theory of mind:** Theory of mind is a psychology term. When applied to AI, it means that the system would have the social intelligence to understand emotions. This type of AI will be able to infer human intentions and predict behavior, a necessary skill for AI systems to become integral members of human teams.

- **Type 4: Self-awareness:** In this category, AI systems have a sense of self, which gives them consciousness. Machines with self-awareness understand their own current state. This type of AI does not yet exist.

➤ Need of Artificial Intelligence:

While the Artificial Intelligence (AI) technology is making its presence felt across the spectrum globally, India needs to prioritise AI-based predictive analysis to improve outcomes in three core areas — agriculture, healthcare and education, a top <u>Microsoft</u> executive has emphasised. The initial results in India are promising and if deployed at big scale, AI-based models can help farmers, doctors and educators keep building success stories, Joseph Sirosh, Corporate Vice President of Cloud AI Platform at Microsoft, told IANS here.

"For example, AI can help us foresee signs of a student being at risk of dropping out. We have done first such experiment in Andhra Pradesh involving thousands of students," Sirosh informed. In 2017, the Andhra Pradesh government expanded the rollout of the experiment to all 13 districts in the state. In Visakhapatnam district, an application powered by Azure Cloud Machine Learning (ML) processed the data pertaining to all students — based on parameters such as gender, socio-economic demographics, academic performance, school infrastructure and teacher skills — to find predictive patterns.

The results showed that some of the factors leading to students dropping out were insufficient furniture, inadequate toilet infrastructure, etc. Based on these results, the state government identified about 19,500 probable dropouts from government schools in Visakhapatnam district in the next academic year (2018-19).

"Not just India, AI-based predictive analysis has also helped Tacoma School District here in Washington state improve graduation rate from under 60 per cent to over 83 per cent by managing dropouts," Sirosh noted.

When it comes to agriculture, Microsoft, in collaboration with the non-profit International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), has developed an AI-sowing app for farmers in India. The tech giant is using AI and historic weather data to predict the best time for sowing seeds and other stages of the farming process, and pass on that information to farmers via SMS.

We have done some amazing work, like informing farmers when to sow crops, what is the best time to plant crops during the year, etc. The result is 30 per cent more yield," Sirosh told IANS. The farmers do not need to install any sensors in their fields or incur any capital expenditure. All they need is a mobile phone capable of receiving text messages. To determine the optimal sowing period, the Moisture Adequacy Index (MAI) is calculated. MAI is the standardised measure used for assessing the degree of adequacy of rainfall and soil moisture to meet the potential water requirement of crops.

➢ Appliction of Artificial Intelliagence in Various domain:

- **AI in Healthcare:** Companies are now applying machine learning to make better and faster diagnoses than humans. Through AI and deep learning, doctors can promptly diagnose cancer, before it's too late. AI improves reliability, predictability, and consistency with quality and patient safety. One of the widely used healthcare technologies is IBM Watson. It understands natural language processing which is capable of responding to questions asked of it. The system mines patient data and other available data sources to form a report, which it then presents with a confidence scoring schema.

  An organization named Cambio Health Care has recently developed a clinical decision support system for stroke prevention that will give the physician a warning whenever there is a patient who is at risk of having a heart stroke.

- **AI in Agriculture:** Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, is all set to become the most disruptive technology in

agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency. AI can help farmers get more from the land while using resources more sustainably.

Organizations are using automation and robotics to help farmers find more efficient ways to protect their crops from weeds. Currently, even Microsoft is working with 175 farmers in Andhra Pradesh, India to provide advisory AI services for sowing, land, fertilizer and so on. This initiative has already resulted in 30% higher yield per hectare on an average compared to last year.

- **AI in Education:** AI has already been applied to education systems primarily in some tools that are helping us to develop skills and testing systems. As AI educational solutions continue to mature everyday, the hope is that AI can help in filling needs gaps in learning and teaching thus allowing schools and teachers to do more than ever before. AI can drive efficiency, personalization and streamline admin tasks so as to allow teachers the time and freedom to provide understanding and adaptability—uniquely human capabilities where a machine would struggle. And by leveraging the best attributes of machines and teachers, the vision for AI in education is one where they work together for a better outcome for students. Since the students of today will need to work in a future where AI is the reality, it's also important that our educational institutions expose students to use and adapt the technology.

- **AI in Human Resource Management**: Artificial Intelligence and Machine learning are going to drastically and irrevocably change how HR Management and recruitment work in every company and this is going to be something to watch for. HR is likely to be one of the first areas of business that will benefit from AI for two simple reasons. Firstly there are tons of top quality data in HR, and secondly, HR is one part of any company that is both essential and yet feels the pressure of time.

2. To study 3D Printing Technologies its Need and Application in various domain.

➢ 3D Printing:

▪ What is 3D Printing?

1. Create a digital design: The first stage is to create a digital model in a 3D modeling program (CAD – Computer Aided Design) or by using a 3D scanner. Another option is to find a pre-existing 3D model design, for example from a company database or design-sharing website.

2. Import: Next, import the design to 3D printing software, such as Ultimaker Cura. This free and open-source software slices the digital model into layers, and converts these into a G-code file, which can be 'read' by the 3D printer.

3. Save / transfer: The Ultimaker Cura file is saved to a USB, which is inserted into your machine. Alternatively, the file can be saved to the cloud, then sent to the printer.

4. 3D print: The final step is to press print. The printers produce layers of material, one on top of the other. This forms the finished object. Desktop printers usually use plastic filaments, which are fed in, then melted in the print head. This liquid substance is extruded onto the build plate.

▪ What is 3D Printing used for?

1. **Product development:** It's not easy (or cheap) to develop a product. Having an in-house desktop 3D printer enables businesses to test out different iterations, at a fraction of the cost. Idea Reality's case study highlights how beneficial rapid prototyping for product development can be.

2. **On-demand manufacturing:** Manufacturing companies have to be reactive to their clients' needs. 3D printing lets packaging company Gerhard Schubert GmbH develop customized tools on demand, helping them to offer a more responsive, adaptable service for their clients.

3. **Explaining complex concepts:** Architects and designers like Dubai-based Killa Design create detailed 3D models to showcase complicated designs to contractors, manufacturers, and engineers. This ensures everyone has full understanding of the project.

- ## Different types of 3D Printing Technology:

  There are several different types of printing technologies. The most widely-used are:

  1. **Stereolithography (SLA):** This was the first 3D printing technology to be developed. It uses a stereolithograph apparatus to transform liquid material into a solid printed object. Digital light processing (DLP) is very similar.

  2. **Selective laser sintering (SLS):** Selective laser sintering is similar to stereolithography, but uses powdered material (stereolithography uses a liquid resin). Selective laser melting (SLM) is a subcategory of this type of 3D printing process, and Electronic Beam Melting (EBM) is another, though it uses an electron beam instead of a laser.

  3. **Fused filament fabrication (FFF):** Ultimaker's desktop 3D printers use fused filament fabrication. The filament is heated through a nozzle, then deposited on the build plate below. FFF builds the printed object up, layer by layer, using a heated thermoplastic filament.

- # What is Need of 3D Printing?

  3D printing is inexpensive prosthetics, creating spare parts, rapid prototyping, creating personalized items and manufacturing with minimum waste. The technology is useful and thanks to its widespread availability as well as further development will be even more useful in the future

  For some, 3D printing might seem childish and toy-like. After all, what can you print in a 3D printer? A whistle or a figurine of a video game character, right? In fact, 3D printing is a powerful technology which is already providing significant savings to companies. Its future is even more promising.

  3D printing is taking more and more branches of the economy by storm. Up until recently it has been used only experimentally by universities and large corporations. Today, thanks to companies such as Zortrax, it's readily available. Just order a 3D printer online today and tomorrow you will be able to enjoy your new device. On the other hand, the question that's often asked is: why 3D printing, what can this technology be used for? Pessimists like to show examples of minor, simple 3D printed items which could have easily been manufactured with a different method and maybe would've even been cheaper. However; 3D printing is very useful when you know how to utilize it and what you want to achieve. The technology has a wide range of prospects, therefore more and more universities are establishing departments focused on 3D printing and skills related to 3D printing are valued by many companies. Experts in the field of 3D printing are in high demand.

- **Appliction of 3D Printing in Various domain:**

❖ **In Education:**

1. Engineering design students can print out prototypes

2. Architecture students can print out 3D models of designs

3. History classes can print out historical artifacts for examination

4. Graphic Design students can print out 3D versions of their artwork

5. Geography students can print out topography, demographic, or population maps

6. Cooking students can create molds for food products

7. Automotive students can print out replacement parts or modified examples of existing parts for testing

8. Chemistry students can print out 3D models of molecules

9. Biology students can print out cells, viruses, organs, and other critical biological artifacts

10. Math students can print out "problems" to solve in their own learning spaces, from scale models to city infrastructural design challenges

❖ **In Agriculture:**

1. Manufacturing Tools: One of the key advantages of 3D printing is customization. Custom tools can be expensive if manufactured traditionally, but 3D printing can create these products quickly and inexpensively.

If a farmer needs a specialized tool to perform a specific job, they can have one 3D printed one in as little as a day.

This ease of customization allows farmers to accomplish even the most unusual tasks with greater ease and comfort. 3D printing wax or resin casts or patterns is the most affordable process for making tools but binder jetting with ExOne could also be used for this application.

2. Scale Models: A growing farm will need new buildings, which are considerable investments. When planning structures like grain facilities, farmers need to design them carefully so construction goes smoothly and stays within budget. By 3D printing scale models of the structures they wish to build, they can make the planning process more comprehensive.

Farmers can use prototypes for more than construction. Using technology like LiDar, they can scan and create 3D models of their farmland to understand the area's terrain better. These representations can highlight issues like erosion or catchment spots, which are zones where water collects from the surrounding land.

❖ In Healthcare:

1. 3D-Printed Orthopaedic Implants: <u>Orthopaedic implants</u> — medical devices used to surgically replace a missing joint or bone — are one of the applications that benefit the most from 3D printing. The technology enables medical professionals to create better-fitting, longer-lasting and higher-performing implants.

The first use of 3D printing for orthopaedic implants dates back over a decade, with the first 3D-printed implants manufactured around 2007. In 2010, Adler Ortho Group, an early adopter of Arcam's Electron Beam Melting (EBM) metal 3D printing technology, received the first FDA approvals for implants created by 3D printing.

Despite current challenges, 3D printing individualised implants represents a key opportunity for the orthopaedic segment, and one that will see tremendous growth in the years ahead.

2. Personalised Surgery: Anatomical models are currently one of the most widely adopted applications of 3D printing in the medical industry. The accessibility of medical CAD/CAM software and lower-cost desktop 3D printers is increasing, enabling more hospitals to establish 3D printing labs.

In such labs, medical professionals can produce high-accuracy 3D-printed models to assist in presurgical planning. 3D-printed anatomical models help surgeons evaluate better treatment decisions and plan their surgeries more accurately. The process begins by taking CT or MRI scans. The scans are then analysed and modified to remove undesired areas and keep the regions of interest (a process known as segmentation). Bones, vessels and solid organs all need to be modelled in different ways. Once the digital model is created, it is converted into an STL file format, prepared for printing and sent to a 3D printer.

❖ In Real Estate:

Technology disrupts industries. Real estate has probably seen some of the highest number of disruptions come new, innovative inventions. Additive manufacturing is a new and very intriguing new technology in real estate that is taking ingenuity and convenience to a whole new level. 3D Printing has been doing the rounds of the media for quite a while now. It is being used in all spheres of business to create things ranging from commonplace to rare. Scientists have gone so far as to create a human ear (yes, you read that right!) using a 3D printer. But what implications has this technology gotten on real estate?

Another instance is the small 3D printed house built by Baylor University engineering graduate Alex Le Roux. He also built 'The Vesta', a 3D printer which can build a small house in a day. The houses being built using additive manufacturing are currently quite basic and elementary at best. However, it's a start. If trend forecasts are anything to go by, 3D printing is set to revolutionize the real estate industry dramatically.

3. To study Internet of Things its Need and Application in various domain.

➢ Internet of Things:

▪ What is the Internet of Things?

In the broadest sense, the term IoT encompasses everything connected to the internet, but it is increasingly being used to define objects that "talk" to each other. "Simply, the Internet of Things is made up of devices – from simple sensors to smartphones and wearables – connected together," Matthew Evans, the IoT programme head at techUK, says.

By combining these connected devices with automated systems, it is possible to "gather information, analyse it and create an action" to help someone with a particular task, or learn from a process. In reality, this ranges from smart mirrors to beacons in shops and beyond.

"It's about networks, it's about devices, and it's about data," Caroline Gorski, the head of IoT at Digital Catapult explains. IoT allows devices on closed private internet connections to communicate with others and "the Internet of Things brings those networks together. It gives the opportunity for devices to communicate not only within close silos but across different networking types and creates a much more connected world."

▪ What is Need of IoT:

1. The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices."

2. This would mean that normal everyday household items will be integrated with sophisticated tech to do more.

3. You might also know IoT as "smart". At the moment, it is currently in the infancy stage with some devices around like smart TVs, smart refrigerators and smart entry locks. Sooner or later, things like driverless cars and personal assistant devices (e.g. Google Glass) would become the norm.

4. These devices work by using sensors that transmit data to a computer or software, allowing them to perform important tasks. Due to their utility and high levels of automation, there has been an increase in the number of devices being connected to the internet. On average, there are 127 objects being synced up every second.

▪ Applictions of Internet of Things in Various domain:

❖ In Education Sector:

1. Smart Boards: The times have changed. The current day students enjoy smart boards way more than black boards. Smart boards are interactive white boards that projects subject images. It enables the teachers and students to interact with it. How? By simply writing on it or moving it around the class. It is much more fun and exciting than it is seems at the moment. It is common to think whether smart boards have the ability to replace black boards in all means or not. The answer is 'Yes'. Words and illustrated figures on a black board or text books, fall short at times to express the concept of a lesson in minute ways. Perception clashes become common and hence the classroom ends up in a pool of confusion. Here, applications of IoT in education have managed to make education and the exchange of information simple, interesting and interactive. With smart boards, a teacher can take a sigh of relief. Info graphics, tutorial videos and complex formulae, be it for any subject and especially of mathematics, could be solved in shorter time frames.

2. Attention to Attendance: Different education institutes have different set of rules. Some believe that a certain percentage of student attendance is mandatory for allowing them to take the examination. With IoT, the management can pull out accurate data of attendance. That data remains free from human error. Safety and quality of life through real time location of hostel living students could also be traced. For the management, it gets frustrating to calculate the attendance at times. With IoT based attendance system, calculating student attendance and generating regularity, punctuality and personality reports becomes effortless. The amount of time it saves will have a tremendous effect on employee satisfaction working for the institute.

3. Mobile Applications and Tablets: There must be a limit to the gadget usage of the millennial students. But, unfortunately, the lives of these modern student's seem to revolve around smartphones, tablet and other screen oriented electronics. <u>IoT experts</u> have wonderfully shifted this excess focus on gadgets for gaming and social networking to educational themes. Now, connecting to individuals across the globe having similar goals and interests is now effortless. The sensors of the Internet of Things in education collect data and automatically suggest academic topics of interest to the students sitting on the other side of the screen. Smartphones and tablet usage has been made beneficial for the student's grade almost overnight.

❖ In Agriculture:

1. **Crop Monitoring:** Sensors placed along the farms monitor the crops for changes in light , humidity, temperature, shape and size. Any anomaly is detected by the sensors is analysed and farmer is notified. Thus remote sensing can help prevent the spread of diseases and keep an eye on the growth of crops.

2. **Weather conditions:** The data collected by sensors in terms of humidity, temperature, moisture precipitation and dew detection helps in determining the weather pattern in farms so that cultivation is done for suitable crops.

3. **Soil quality:** The analysis of quality of soil helps in determining the nutrient value and drier areas of farms, soil drainage capacity or acidity, which allows to adjust the amount of water needed for irrigation and the opt most beneficial type of cultivation.

❖ **In Healthcare:**

1. Cancer treatment

2. Smart continuous glucose monitoring (CGM) and insulin pens

3. Closed-loop (automated) insulin delivery

4. Connected inhalers

5. Ingestible sensors

6. Connected contact lenses

4. To study Machine Learning its Need and Application in various domain.

➢ Machine Learning:

▪ WHAT IS MACHINE LEARNING?

At a very high level, machine learning is the process of teaching a computer system how to make accurate predictions when fed data.Those predictions could be answering whether a piece of fruit in a photo is a banana or an apple, spotting people crossing the road in front of a self-driving car, whether the use of the word *book* in a sentence relates to a paperback or a hotel reservation, whether an email is spam, or recognizing speech accurately enough to generate captions for a YouTube video.

The key difference from traditional computer software is that a human developer hasn't written code that instructs the system how to tell the difference between the banana and the apple.Instead a machine-learning model has been taught how to reliably discriminate between the fruits by being trained on a large amount of data, in this instance likely a huge number of images labelled as containing a banana or an apple.Data, and lots of it, is the key to making machine learning possible.

▪ What is Need of Machine Learning:

Because of new computing technologies, machine learning today is not like machine learning of the past. It was born from pattern recognition and the theory that computers can learn without being programmed to perform specific tasks; researchers interested in artificial intelligence wanted to see if computers could learn from data. The iterative aspect of machine learning is important because as models are exposed to new data, they are able to independently adapt. They learn from previous computations to produce reliable, repeatable decisions and results. It's a science that's not new – but one that has gained fresh momentum.

While many machine learning algorithms have been around for a long time, the ability to automatically apply complex mathematical calculations to big data – over and over, faster and faster – is a recent development. Here are a few widely publicized examples of machine learning applications you may be familiar with:

- The heavily hyped, self-driving Google car? The essence of machine learning.
- Online recommendation offers such as those from Amazon and Netflix? Machine learning applications for everyday life.
- Knowing what customers are saying about you on Twitter? Machine learning combined with linguistic rule creation.
- Fraud detection? One of the more obvious, important uses in our world today.

Resurging interest in machine learning is due to the same factors that have made data mining and Bayesian analysis more popular than ever. Things like growing volumes and varieties of available data, computational processing that is cheaper and more powerful, and affordable data storage.

All of these things mean it's possible to quickly and automatically produce models that can analyze bigger, more complex data and deliver faster, more accurate results – even on a very large scale. And by building precise models, an organization has a better chance of identifying profitable opportunities – or avoiding unknown risks.

- **Applictions of Machine Learning in Various domain:**

  1. Health care: Machine learning is a fast-growing trend in the health care industry, thanks to the advent of wearable devices and sensors that can use data to assess a patient's health in real time. The technology can also help medical experts analyze data to identify trends or red flags that may lead to improved diagnoses and treatment.

  2. Finnancial Service: Banks and other businesses in the financial industry use machine learning technology for two key purposes: to identify important insights in data, and prevent fraud. The insights can identify investment opportunities, or help investors know when to trade. Data mining can also identify clients with high-risk profiles, or use cybersurveillance to pinpoint warning signs of fraud.

3. Transportation: Analyzing data to identify patterns and trends is key to the transportation industry, which relies on making routes more efficient and predicting potential problems to increase profitability. The data analysis and modeling aspects of machine learning are important tools to delivery companies, public transportation and other transportation organizations.

5. To study Data Science its Need and Application in various domain.

➢ Data Science:

Data science continues to evolve as one of the most promising and in-demand career paths for skilled professionals. Today, successful data professionals understand that they must advance past the traditional skills of analyzing large amounts of data, data mining, and programming skills. In order to uncover useful intelligence for their organizations, data scientists must master the full spectrum of the data science life cycle and possess a level of flexibility and understanding to maximize returns at each phase of the process.

The term "data scientist" was coined as recently as 2008 when companies realized the need for data professionals who are skilled in organizing and analyzing massive amounts of data. [1] In a 2009 McKinsey&Company article, Hal Varian, Google's chief economist and UC Berkeley professor of information sciences, business, and economics, predicted the importance of adapting to technology's influence and reconfiguration of different industries.

Effective data scientists are able to identify relevant questions, collect data from a multitude of different data sources, organize the information, translate results into solutions, and communicate their findings in a way that positively affects business decisions. These skills are required in almost all industries, causing skilled data scientists to be increasingly valuable to companies.

▪ What is need of Data Science:

Data science can add value to any business who can use their data well. From statistics and insights across workflows and hiring new candidates, to helping senior staff make better-informed decisions, data science is valuable to any company in any industry.

The purpose of Data Scientists is to extract, pre-process and analyze data. Through this, companies can make better decisions. Various companies have their own requirements and use data accordingly. In the end, the goal of Data Scientist to make businesses grow better.

Data creates magic. Industries need data to help them make careful decisions. Data Science churns raw data into meaningful insights. Therefore, industries need data science.

A Data Scientist is a wizard who knows how to create magic using data. A skilled Data Scientist will know how to dig out meaningful information with whatever data he comes across. He helps the company in the right direction. The company requires strong data-driven decisions at which he's an expert. The Data Scientist is an expert in various underlying fields of Statistics and Computer Science. He uses his analytical aptitude to solve business problems.

▪ Applications of Data Science in various domain:

Data Science has created a strong foothold in several industries such as medicine, banking, manufacturing, transportation etc. It has immense applications and has variety of uses. Some of the following applications of Data Science are:

1. Data Science in Healthcare: Data Science has been playing a pivotal role in the HealthcareIndustry. With the help of classification algorithms, doctors are able to detect cancer and tumors at an early stage using Image Recognition software. *Genetic Industries use Data Science for analyzing and classifying patterns of genomic sequences*. Various virtual assistants are also helping patients to resolve their physical and mental ailments.

2. Data Science in E-commerce: Amazon uses a recommendation system that recommends users various products based on their historical purchase. Data Scientists have developed recommendation systems predict user preferences using Machine Learning.

3. Data Science in Manufacturing: Industrial robots have made taken over mundane and repetitive roles required in the manufacturing unit. These industrial robots are autonomous in nature and use Data Science technologies such as Reinforcement Learning and Image Recognition.

4. Data Science as Conversational Agents: Amazon's Alexa and Siri by Apple use Speech Recognition to understand users.

Data Scientists develop this speech recognition system, that converts human speech into textual data. Also, it uses various Machine Learning algorithms to classify user queries and provide an appropriate response.

5. Data Science in Transport: Self Driving Cars use autonomous agents that utilize Reinforcement Learning and Detection algorithms. Self-Driving Cars are no longer fiction due to advancements in Data Science.

6. To study Data Analytics its Need and Application in various domain.

➢ Data Analytics:
▪ What Is Data Analytics?

The term data analytics refers to the process of examining datasets to draw conclusions about the information they contain. Data analytic techniques enable you to take raw data and uncover patterns to extract valuable insights from it. Today, many data analytics techniques use specialized systems and software that integrate machine learning algorithms, automation and other capabilities. Data Scientists and Analysts use data analytics techniques in their research, and businesses also use it to inform their decisions. Data analysis can help companies better understand their customers, evaluate their ad campaigns, personalize content, create content strategies and develop products. Ultimately, businesses can use data analytics to boost business performance and improve their bottom line. For businesses, the data they use may include historical data or new information they collect for a particular initiative. They may also collect it first-hand from their customers and site visitors or purchase it from other organizations. Data a company collects about its own customers is called first-party data, data a company obtains from a known organization that collected it is called second-party data, and aggregated data a company buys from a marketplace is called third-party data. The data a company uses may include information about an audience's demographics, their interests, behaviors and more.

Data analytics is the science of analyzing raw data in order to make conclusions about that information. Many of the techniques and processes of data analytics have been automated into mechanical processes and algorithms that work over raw data for human consumption.

▪ What is need of Data Analytics:

Data analytics is important because it helps businesses optimize their performances. Implementing it into the business model means companies can help reduce costs by identifying more efficient ways of doing business and by storing large amounts of data.

The main role of data analysts in an organization is to help decision-makers by identifying interesting and important patterns in data and providing quick answers buried in tons of tables, graphs, and log files.

Data is core to the business and has always been core to it. There is a saying, you can't improve what you can't measure. so, businesses have been trying to setup metrics for their core business parameters. Traditionally most of this data was structured data, stored in sort of relational databases in the controlled business environment. Businesses were clearly governed by the reports based on this structured data.

With the advancements of new technologies, like social media evolution, mobile technologies, big data storage and processing, cloud technology and machine learning — Data got a completely new dimension. Data came outside, or at least the presence was felt outside of its four boundaries of the enterprises. Now, the data is present everywhere. Every second, someone, somewhere is collecting a lot of data about us. Every action is producing some data. Lot of this data is unstructured. There is a huge volume of this data, there is variety in this data and it comes in burst.

▪ Applications of Data Science in various domain:

❖ In Education:

1. Educational data-mining

Through this approach we can build predictive models e.g., can identify at-risk learners (risk of dropping out the course) and can help teachers provide intervention to assist learners in achieving success.

2. Intelligent curriculum and adaptive content

Through student`s data We can develop as many curricula as many students We have. Based on their preferences (and skills) it is possible to develop a recommenders system where different students could, such as, follow different ways to learn the same content.

3. Adaptive learning

It is not only adaptive content, as mentioned above, but it is possible to offer learners support, offering them other opportunities of engagement (if engagement is a student problem).

4. Assisting management decisions

Data analytics in education can improve administrative decision-making and organizational resource allocation. For example, They can know which facilities In the school the students like more (or less). It also can provide feedback to school`s administrators.

❖ In Healthcare:

- Electronic Health Records (EHR): Clinical records with patient details.
- Laboratory Information Management system (LIMS): Contains lab results
- Monitoring and diagnostic instruments: Data from instruments like MRI.
- Pharmacy: Medication details of the patient
- Insurance claim and billing: Contains insurance claims and billing details
- Hospital Resources: Employee list and hospital supply chain details.

❖ In Agriculture:

1. Boosting productivity and innovation: With global food demand set to surge almost twofold by 2050, it will be incumbent upon farmers and agricultural suppliers to harness data and innovation to improve productivity and feed a growing global population. Armed with data from soil sensors, GPS-equipped tractors, and external sources such as local weather channels,

farmers who implement precision agriculture are gaining unprecedented visibility into their operations. This enables them to better manage key resources including seed, fertiliser, and pesticides, while increasing productivity.

2. Managing environmental challenges: Climate change and other environmental challenges rank amongst the biggest threats to agricultural productivity, but data-driven farming can help make it easier for farmers to navigate shifts in environmental conditions, helping to combat climate change by enabling smarter resource management.

❖ In Real Estate:

1. Property Price Indices: Data science applications to investing have proliferated in finance, and today data-driven computer models account for up to 80% of trading, as reported in news articles and expert commentary. Unlike publicly listed equities, however, every reported transaction in real estate represents the exchange of a unique asset — and no two properties are ever identical. Even when two units in the same building are transacted, they can be drastically different, and pricing can be considerably different.

This presents a specific problem for real estate — how do we harness large data sets to understand individual sub-market performance? Taking simple averages of historical transactions can be biased if the types of properties transacted in each period vary, and there is subjectivity in determining what properties to include or exclude in the average, to the extent that different researchers could end up with different pictures of historical performance.

2. Automated Valuation Models: Statistical approaches to valuation are gaining traction globally, with some examples being the Zillow Zestimate in the US, UrbanZoom in Singapore, and SkenarioLabs in Finland. The goal of any automated valuation model is to harness data to produce an estimate of a property's market value — where it would transact between a willing buyer and seller, at arm's length, without compulsion.

Approaches similar to those in indexation are employed, with potentially more advanced data science techniques being deployed to take advantage of online learning and ensemble methods. However, the final output is different. Rather than an index, the goal is a point (or range) estimate of an asset's value. The direct benefit is greater precision on the fair market value of a property, produced instantaneously and at low cost. These valuations are useful not just to pricing properties, but also to assessing the mortgages and portfolios of loans backing these assets.

7. To study Block Chain Technology its Need and Application in various domain.

➢ Block Chain Technology:

A blockchain is, in the simplest of terms, a time-stamped series of immutable records of data that is managed by a cluster of computers not owned by any single entity. Each of these blocks of data (i.e. block) is secured and bound to each other using cryptographic principles (i.e. chain).

So, what is so special about it and why are we saying that it has industry-disrupting capabilities?

The blockchain network has no central authority — it is the very definition of a democratized system. Since it is a shared and immutable ledger, the information in it is open for anyone and everyone to see. Hence, anything that is built on the blockchain is by its very nature transparent and everyone involved is accountable for their actions.

"Blocks" on the blockchain are made up of digital pieces of information. Specifically, they have three parts:

1. Blocks store information about transactions like the date, time, and dollar amount of your most recent purchase from Amazon. (NOTE: This Amazon example is for illustrative purchases; Amazon retail does not work on a blockchain principle as of this writing)

2. Blocks store information about who is participating in transactions. A block for your splurge purchase from Amazon would record your name along with Amazon.com, Inc. (AMZN). Instead of using your actual name, your purchase is recorded without any identifying information using a unique "digital signature," sort of like a username.

3. Blocks store information that distinguishes them from other blocks. Much like you and I have names to distinguish us from one another, each block stores a unique code called a "hash" that allows us to tell it apart from every other block. Hashes are cryptographic codes created by special algorithms. Let's say you made your splurge purchase on Amazon, but while it's in transit, you decide you just can't resist and need a second one. Even though the details of your new transaction would look nearly identical to your earlier purchase, we can still tell the blocks apart because of their unique codes.

- ## Applications of Block Chain Technology in various domain:

  Recent numbers show that the asset management industry could cut costs by $2.7 billion every year by moving to blockchain tech. Practical applications of blockchain in the financial services industry include client screening and onboarding, recordkeeping, data privacy and **security**, and trade processing.

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- ## Applications That Are Transforming Society:

1. Asset Management: Trade Processing and Settlement

2. Insurance: Claims processing

3. Payments: Cross-Border Payments

4. Unconventional money lenders/ hard money lending

5. Your car/ smartphone

6. Blockchain Internet-of-Things (IoT)

7. Smart Appliances

8. Supply Chain Sensors
9. Blockchain Healthcare

10. Blockchain music

11. Blockchain Government

12. Public value/ community

13. Vested responsibility

14. Blockchain Identity

15. Passports

16. Birth, wedding, and death certificates

17. Personal Identification

8. To study Cyber Security its Need and Application in various domain.

➢ Cyber Security:

▪ **Defination:** Cyber security refers to the body of technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access. Cyber security may also be referred to as information technology security.

▪ **THE IMPORTANCE OF CYBER SECURITY**

Cyber security is important because government, military, corporate, financial, and medical organizations collect, process, and store unprecedented amounts of data on computers and other devices. A significant portion of that data can be sensitive information, whether that be intellectual property, financial data, personal information, or other types of data for which unauthorized access or exposure could have negative consequences. Organizations transmit sensitive data across networks and to other devices in the course of doing businesses, and cyber security describes the discipline dedicated to protecting that information and the systems used to process or store it. As the volume and sophistication of cyber attacks grow, companies and organizations, especially those that are tasked with safeguarding information relating to national security, health, or financial records, need to take steps to protect their sensitive business and personnel information. As early as March 2013, the nation's top intelligence officials cautioned that cyber attacks and digital spying are the top threat to national security, eclipsing even terrorism.

▪ What is need of Cyber Security:

For an effective cyber security, an organization needs to coordinate its efforts throughout its entire information system. Elements of cyber encompass all of the following:

- **Network security:** The process of protecting the network from unwanted users, attacks and intrusions.
- **Application security:** Apps require constant updates and testing to ensure these programs are secure from attacks.

- **Endpoint security:** Remote access is a necessary part of business, but can also be a weak point for data. Endpoint security is the process of protecting remote access to a company's network.

- **Data security**: Inside of networks and applications is data. Protecting company and customer information is a separate layer of security.

- **Identity management:** Essentially, this is a process of understanding the access every individual has in an organization.

- **Database and infrastructure security:** Everything in a network involves databases and physical equipment. Protecting these devices is equally important.

- **Cloud security:** Many files are in digital environments or "the cloud". Protecting data in a 100% online environment presents a large amount of challenges.

- **Mobile security:** Cell phones and tablets involve virtually every type of security challenge in and of themselves.

- **Disaster recovery/business continuity planning:** In the event of a breach, natural disaster or other event data must be protected and business must go on. For this, you'll need a plan. End-user education: Users may be employees accessing the network or customers logging on to a company app. Educating good habits (password changes, 2-factor authentication, etc.) is an important part of cybersecurity.

The most difficult challenge in cyber security is the ever-evolving nature of security risks themselves. Traditionally, organizations and the government have focused most of their cyber security resources on perimeter security to protect only their most crucial system components and defend against known treats. Today, this approach is insufficient, as the threats advance and change more quickly than organizations can keep up with. As a result, advisory organizations promote more proactive and adaptive approaches to cyber security. Similarly, the National Institute of Standards and Technology (NIST) issued guidelines in its risk assessment framework that recommend a shift toward continuous monitoring and real-time assessments, a data-focused approach to security as opposed to the traditional perimeter-based model.

- **Applications of Cyber Security in various domain:**.

1. Business protection against malware, ransomware, phishing and social engineering.
2. Protection for data and networks.
3. Prevention of unauthorized users.
4. Improves recovery time after a breach.
5. Protection for end-users.
6. Physical Ssecurity
7. Legal, Regulation, Investigations and Compliance.
8. Business Continuity and Disaster recovery.
9. Operations Security.
10. Access Control.
11. Telecommunication and Network Security.
12. Software Development.
13. Crpytography.

9. To study Cloud Computing its Need and Application in various domain.

➢ Cloud Computing:

▪ **What is cloud computing, in simple terms?**

Cloud computing is the delivery of on-demand computing services -- from applications to storage and processing power -- typically over the internet and on a pay-as-you-go basis.

▪ **How does cloud computing work?**

Rather than owning their own computing infrastructure or data centers, companies can rent access to anything from applications to storage from a cloud service provider.

One benefit of using cloud computing services is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for what they use, when they use it.

In turn, providers of cloud computing services can benefit from significant economies of scale by delivering the same services to a wide range of customers.

▪ **What cloud computing services are available?**

Cloud computing services cover a vast range of options now, from the basics of storage, networking, and processing power through to natural language processing and artificial intelligence as well as standard office applications. Pretty much any service that doesn't require you to be physically close to the computer hardware that you are using can now be delivered via the cloud.

▪ **Why is it called cloud computing?**

A fundamental concept behind cloud computing is that the location of the service, and many of the details such as the hardware or operating system on which it is running, are largely irrelevant to the user. It's with this in mind that the metaphor of the cloud was borrowed from old telecoms network schematics, in which the public telephone network (and later the internet) was often represented as a cloud to denote that the just didn't matter -- it was just a cloud of stuff.

- ## **What is need of Cloud Computing:**

Building the infrastructure to support cloud computing now accounts for more than a third of all IT spending worldwide, according to research from IDC. Meanwhile spending on traditional, in-house IT continues to slide as computing workloads continue to move to the cloud, whether that is public cloud services offered by vendors or private clouds built by enterprises themselves. 451 Research predicts that around one-third of enterprise IT spending will be on hosting and cloud services this year "indicating a growing reliance on external sources of infrastructure, application, management and security services". Analyst Gartner predicts that half of global enterprises using the cloud now will have gone all-in on it by 2021.

According to Gartner, global spending on cloud services will reach $260bn this year up from $219.6bn. It's also growing at a faster rate than the analysts expected. But it's not entirely clear how much of that demand is coming from businesses that actually want to move to the cloud and how much is being created by vendors who now only offer cloud versions of their products (often because they are keen to move to away from selling one-off licences to selling potentially more lucrative and predictable cloud subscriptions).

Cloud computing allows people access to the same kinds of applications through the internet. ... This means the device accessing the cloud doesn't need to work as hard. By hosting software, platforms, and databases remotely, the cloud servers free up the memory and computing power of individual computers.

Cloud computing has been evolving the way businesses operate these days. Companies of all the shapes and sizes have been adapting to this new technology. Industry experts believe that cloud computing will continue to benefit the mid-sized and large companies in the coming few years.

A cloud can be useful for many completely different things where many systems are combined in some way and you don't need to deal with the details in how it works. It can be many computers cooperating in providing one big service for many users (like Gmail, for instance), or it can be a SAN with a number of hypervisors who can run lots of smaller virtual machines doing different things often moving the VMs between hypervisors as an automated load balancing thing. This also means that you can run clouds inside of clouds; you can rent a number of VMs and storage from Amazon, for instance and unite them to provide a big CRM system or something.

- **Applications of Cloud Computing in various domain:**

1. Art Applications: Cloud computing offers various art applications for quickly and easily design attractive cards, booklets**,** and images. Some most commonly used cloud art applications are given below:

2. Business Applications: Business applications are based on cloud service providers. Today, every organization requires the cloud business application to grow their business. It also ensures that business applications are 24*7 available to users.

3. Data Storage and Backup Applications: Cloud computing allows us to store information (data, files, images, audios, and videos) on the cloud and access this information using an internet connection. As the cloud provider is responsible for providing security, so they offer various backup recovery application for retrieving the lost data.

Google G Suite: Google G Suite is one of the best cloud storage and backup application. It includes Google Calendar, Docs, Forms, Google+, Hangouts, as well as cloud storage and tools for managing cloud apps. The most popular app in the Google G Suite is Gmail. Gmail offers free email services to users.

4. Education Applications: Cloud computing in the education sector becomes very popular. It offers various online distance learning platforms and student information portals to the students. The advantage of using cloud in the field of education is that it offers strong virtual classroom environments, Ease of accessibility, secure data storage, scalability, greater reach for the students, and minimal hardware requirements for the applications.

5. Entertainment Applications: Entertainment industries use a multi-cloud strategy to interact with the target audience. Cloud computing offers various entertainment applications such as online games and video conferencing.

6. Management Applications: Cloud computing offers various cloud management tools which help admins to manage all types of cloud activities, such as resource deployment, data integration, and disaster recovery. These management tools also provide administrative control over the platforms, applications, and infrastructure.

7. Social Applications: Social cloud applications allow a large number of users to connect with each other using social networking applications such as **Facebook, Twitter, Linkedln,** etc.

10. To study Industry 4.0 its Needs and List Minimum 20 IT Product based and Service based Industry.

➢ **Industry 4.0**

▪ **What is Industry 4.0?**

Industry 4.0 is the digital transformation of manufacturing/production and related industries and value creation processes. Industry 4.0 is used interchangeably with the fourth industrial revolution and represents a new stage in the organization and control of the industrial value chain.

We're in the midst of a significant transformation regarding the way we produce products thanks to the digitization of manufacturing. This transition is so compelling that it is being called Industry 4.0 to represent the fourth revolution that has occurred in manufacturing. From the first industrial revolution (mechanization through water and steam power) to the mass production and assembly lines using electricity in the second, the fourth industrial revolution will take what was started in the third with the adoption of computers and automation and enhance it with smart and autonomous systems fueled by data and machine learning.Even though some dismiss Industry 4.0 as merely a marketing buzzword, shifts are happening in manufacturing that deserves our attention.

- **Industry 4.0 companies that stand out in both IT Product Based & Service Based Industry:**

1. Hosting: Microsoft**:**

2. Industrial IoT Platforms: Microsoft, GE, PTC.

4. Microchips: Nvidia

5. Sensors**:** Festo

6. Connectivity Hardware: HMS

7. Cybersecurity: Claroty

8. Systems Integrators: Accenture

9. Additive Manufacturing: General Electric

10. Augmented and Virtual Reality: Upskill

11. Collaborative Robots: ABB

12. Connected Machine Vision: Cognex

13. Drones / UAVs: PINC

14. Self-Driving (material transport)

15. Siemens

16. SAP

17. ABB

18. GE Digital

19. Honeywell

20. Yokogawa

21. Danaher

22. Big Data

23. Cloud Computing

24. Advanced Robotics

25. Agumented and Virtual Reality(AR/VR).

6. To study Internet of Things its Need and Application in various domain.
7. To study Machine Leanring its Need and Application in various domain.
8. To study Data Science its Need and Application in various domain.
9. To study Data Analytics its Need and Application in various domain.
10. To study Block Chain its Need and Application in various domain.
11. To study 3D Printing Technologies its Need and Application in various domain.
12. To study Cloud Computing its Need and Application in various domain.