বাংলাদেশের সুবর্ণজয়ন্তী Bangladesh 50

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4th Industrial Revolution

10 Technologies

"5-G will be introduced by 2021-23. Introduction of upcoming technologies like artificial intelligence, robotics, big data, block chain and IOT will be expedited."

Hon'ble Prime Minister
Sheikh Hasina.

নথপ্রজাতন্ত্রী বাংলাদেশ সরকার

Ministry of Labour and Employment

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শ্রকম. বাংলা

4th Industrial Revolution
10 Technologies

Ministry of Labour and Employment

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Honorable State Minister
Ministry of Labour and Employment

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Chief Editor
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Over the past 300 years, waves of technology have impacted our lives tremendously, and taken them to a new level. Subsequently, the economic bases have been shifted from agriculture to industrialization. However, we are currently experiencing a fourth Industrial Revolution. The Fourth Industrial Revolution(4IR)—characterized by the fusion of the digital, biological, and physical worlds, as well as the growing utilization of new technologies such as advanced materials, cloud technology, autonomous vehicle including drone, synthetic biology, virtual augmented reality, artificial intelligence, robotics, block chain, 3D printing, internet of things (IoT) and among others has ushered in a new era of economic disruption with uncertain socio-economic consequences globally. In spite of many challenges, the Government of Bangladesh under the leadership of honorable prime minister Sheikh Hasina has ensured the minimum wage of the workers and facilitating the employment opportunities. A clear understanding of automation, the use of modern technologies and presence of skilled human resources are essential to adapting to the fourth industrial revolution (4IR) and making opportunities out of the challenges presented by the prevailing situation. Right now, it is a need for the times to pre plan and prepare for the automation shift in the different sectors. Automation would ensure quality and cost-effective production and ultimately it would bring a positive impact in the national economy.

We would not be able to cope with the 4iR technologies without appropriate knowledge. In order to adopt and adapt to the changes, Ministry of Labour and Employment already started the learning process about those technologies. All over, this document is prepared by the ministry for the training and knowledge sharing purpose. All of the content of these documents are collected from various sources on the internet.

Not but the least, I am thankful to the colleagues, who have worked hard for this document to make this a success and appreciate the initiative indeed.

Index

Advanced Materials

Prepared By -
Md. Humayun Kabir, Join Secretary
Ministry of Labour and Employment

Conventional material vs advanced material:

Conventional material is a material that does not exhibit novel or enhanced properties OR does not exhibit superior performance relative to other materials.

Advanced material is a material that exhibits novel or enhanced properties AND superior performance relative to other materials. These are mainly specifically engineered.

Advanced materials (AdMs):

All materials that represent advances over the traditional materials that have been used for hundreds or even thousands of years … advanced materials refer to all new materials and modifications to existing materials to obtain superior performance in one or more characteristics that are critical for the application under consideration. They can also exhibit completely novel properties [South Africa Department of Trade and Industry-DTI, 2018]

Web-based validation survey under U.S. Army Research Office:

Advanced Material:

"Advanced Materials are materials that are specifically engineered to exhibit novel or enhanced properties that confer superior performance relative to conventional materials. As a result of their unique characteristics, advanced materials have a highly uncertain hazard profile and the potential to require special testing procedures and methods to assess potential for adverse environmental health and safety impacts."

Specifically Engineered:

"Intentionally and knowingly designed for a particular purpose."

Novel: "New and not resembling something formerly known or used, such as a physical phenomenon not previously known for a given material or application, or an entirely new physical phenomenon."

Enhanced:

"Increased, intensified, or further improved in quality, value, or extent."

Superior:

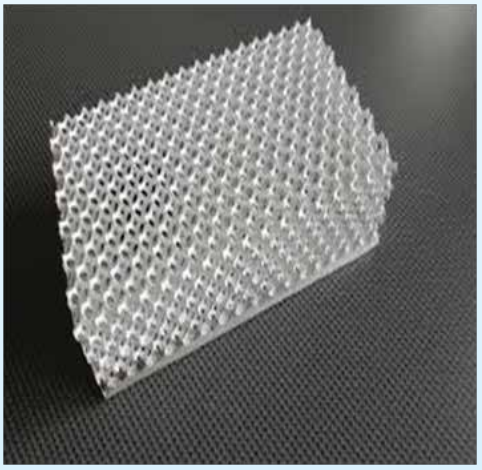
"Better than average, or better than others of the same type."

Additive Manufacturing:

"Additive Manufacturing is a layer-by-layer process of producing 3-dimensional objects directly from a digital model, unlike conventional or subtractive manufacturing processes."

Metal foam is a cellular structure consisting of a solid metal (frequently aluminum) with gas-filled pores comprising a large portion of the volume. The pores can be sealed (closed-cell foam) or interconnected (open-cell foam). The defining characteristic of metal foams is a high porosity: typically, only 5–25% of the volume is the base metal. The strength of the material is due to the square-cube law. Example: Space colonies, floating cities

Example of Some Advance Materials:

1	**LiTraCon:**	 LiTraCon is a translucent concrete building material. The name is short for "light-transmitting concrete". The material is made of 96% concrete and 4% by weight of optical fibers.
	Properties:	Though expensive, Litracon appeals to architects because it is stronger than glass and translucent, unlike concrete`
	Use:	Building skyscrapers, towers, and sculptures
	Replacing:	Glass
02	**Metal foam**	A metal foam is a cellular structure consisting of a solid metal (frequently aluminum) with gas-filled pores comprising a large portion of the volume. 
	Properties:	Fire resistant, nontoxic, recyclable, stronger, resistant to weather adversities of UV light, humidity, and temperature variation
	Use:	Orthopedics: Hip replacement, knee replacement and dental implant surgeries.Automotive, Space colonies, floating cities
	Replacing:	Hulls

06	**Synthetic diamond**	 Synthetic diamond (also referred to as laboratory-grown diamond, laboratory -created diamond, or cultured diamond) is a diamond made of the same material as natural diamonds: pure carbon, crystallized in an isotropic 3D form.
04	**Quantum dots (QDs)**	Quantum dots (QDs) are semiconductor particles a few nanometers in size, having optical and electronic properties that differ from larger particles due to quantum mechanics.
05	**Synthetic spider web**	
	Properties:	This material is not only five times stronger than steel, but also has great elasticity.
	Use:	Its potential uses include: bulletproof clothing, artificial skin for burns or waterproof adhesives.
06	**Shrilk**	
	Properties:	decomposition time is only two weeks
	Replacing:	Plastic
07	**Graphene:**	Graphene is an allotrope of carbon consisting of a single layer of atoms arranged in a two-dimensional honeycomb lattice. The name is a portmanteau of "graphite" and the suffix -ene, reflecting the fact that the graphite allotrope of carbon consists of stacked graphene layers 
Use:		Batteries, photovoltaic solar cells faster computers, flexible electronic devices, more resistant buildings, bionic limbs, etc.

3D Printing

Prepared By -
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Ministry of Labour and Employment

What is 3D Printing?

3D printing or additive production is a procedure of making 3 dimensional strong objects from an electronic file. The production of a 3D printed thing is achieved making use of additive procedures. In an additive procedure a thing is produced by laying down succeeding layers of material until the object is created. Each of these layers can be seen as a very finely cut cross-section of the things. 3D printing is the opposite of subtractive manufacturing which is eliminating/ hollowing out a piece of steel or plastic with as an example a milling machine. 3D printing allows us to generate complicated shapes using much less material than conventional manufacturing methods.

When was 3D Printing Invented?

The sci-fi author, Arthur C. Clarke, was the very first to define the basic functions of a 3D printer back in 1964. Structure on Ralf Baker's work in the 1920s for making attractive short articles. Hideo Kodama's very early work in laser cured material rapid prototyping was finished in 1981. His innovation was broadened upon over the next 3 years, with the introduction of stereo lithography in 1984. The initial 3D printer was launched in 1987 by Chuck Hull of 3D Equipment's and it was making use of the "stereo lithography" (SLA) process. According to Wohlers the adoption of 3D printing maintains growing: greater than 1 million.

3D Printing Technologies

There are three broad sorts of 3D printing modern technology; sintering, melting, and also stereo lithography.
- Sintering is a modern technology where the material is warmed, but not to the point of melting, to create high resolution things. Steel powder is made use of for straight metal laser sintering while thermoplastic powders are used for selective laser sintering.

- Melting techniques of 3D printing consist of powder bed blend, electron beam of light melting and also straight energy deposition, these usage lasers, electric arcs or electron light beams to print things by melting the materials with each other.

- Stereo lithography utilizes photo polymerization to create parts. This innovation uses the correct source of light to connect with the product in a selective fashion to treat and also solidify a random sample of the object in thin layers.

How Does 3D Printing Work?

All of it starts with a 3D design. Anyone can choose to produce one from the ground up or download it from a 3D library. There are many different software tools available. From industrial quality to open source.

Finest 3D software application:

Solidworks.

Solidworks - Market basic design software used for component and also assembly modeling, includes simulation attributes as well as drawing and setting up tools.

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Autodesk AutoCAD

AutoCAD - Autodesk AutoCAD, a software for 2D and 3D CAD, has actually been utilized since 1982. AutoCAD is used throughout a variety of markets, by engineers, job managers, designers, graphic designers, and numerous other experts.

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3D Printing Market

Adoption of 3D printing has actually gotten to critical mass as those who have yet to integrate additive manufacturing someplace in their supply chain are now part of an ever-shrinking minority. Where 3D printing was just appropriate for prototyping as well as one-off production in the early stages, it is now quickly changing right into a production technology.

Instances of 3D Printing

3D printing incorporates several kinds of innovations and also products as 3D printing is being used in mostly all markets we can consider. It is essential to see it as a collection of varied industries with a myriad of various applications.

A couple of instances:

- ⇨ Customer products (glasses, shoes, design, furnishings).
- ⇨ Commercial items (manufacturing tools, prototypes, useful end-use components).
- ⇨ Dental products.
- ⇨ Prosthetics.
- ⇨ Building range versions & maquettes.
- ⇨ Reconstructing fossils.
- ⇨ Reproducing old artifacts.
- ⇨ Reconstructing evidence in forensic pathology.
- ⇨ Motion picture props.

Fast Prototyping & Rapid Manufacturing.

Firms have used 3D printers in their layout procedure to create prototypes since the late seventies. Utilizing 3D printers for these purposes is called quick prototyping.

Why use 3D Printers for Fast Prototyping?

In short: it's fast as well as reasonably economical. From concept, to 3D version to holding a model in your hands is a matter of days instead of weeks. Iterations are less complicated and also more affordable to make and you do not require pricey mold and mildews or tools.

Besides fast prototyping, 3D printing is additionally made use of for quick production. Rapid manufacturing is a brand-new technique of making where services make use of 3D printers for short run/ tiny set custom-made production.

Applications of 3D printing

Here are some examples to show how people used 3D printing and why they chose it for their specific use cases.

Automotive.

Vehicle producers have actually been making use of 3D printing for a very long time. Automotive business is printing extra components, tools, jigs and components yet also end-use components. 3D printing has enabled on-demand manufacturing which has resulted in reduced stock levels and also has shortened layout and also manufacturing cycles.

Aeronautics.

The aviation sector utilizes 3D printing in various methods.

Construction.

Is it possible to print a building? -- Yes, it is. 3D printed residences are currently readily available. Some firms print components prefab as well as others do it on-site.

Consumer Products.

Nowadays there are numerous examples of end-use 3D published consumer products.

Shoes.

Adidas' 4D variety has a fully 3D published midsole as well as is being published in huge quantities. In 2018 they have actually published 100,000 midsoles and also anticipate printing even more in coming years.

Glasses.

The market of 3D printed glasses is forecasted to get to $3.4 billion by 2028. A quickly enhancing area is that of end-use structures. 3D printing is a specifically suitable manufacturing approach for eyeglasses structures due to the fact that the measurements of a person are very easy to process ultimately item.

Precious jewelry.

There are 2 methods of producing fashion jewelry with a 3D printer. One can either make use of a direct or indirect production procedure. Direct refers to the creation of an object directly from the 3D style while indirect production indicates that the object (pattern) that is 3D published becomes made use of to produce a mold for investment spreading.

Medical care.

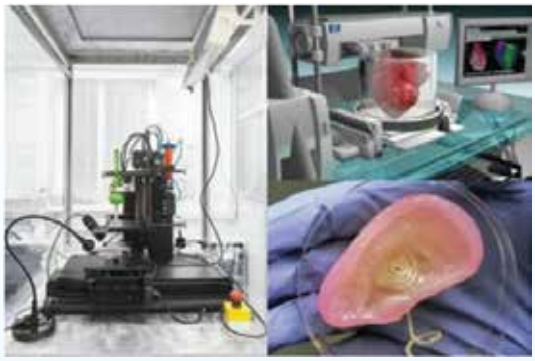
It's not uncommon nowadays to see headings regarding 3D printed implants. Frequently, those instances are speculative, which can make it feel like 3D printing is still a fringe innovation in the medical as well as healthcare sectors, but that's not the case any longer. Over the last decade, more than 100,000 hip substitutes have actually been 3D printed by GE Additive.

Dental.

In the oral market, we see mold and mildews for clear aligners being possibly the most 3D published things in the world. Currently, the mold and mildews are 3D published with both resin and powder-based 3D printing processes, yet likewise through product jetting. Crowns as well as dentures are already straight 3D published, together with medical guides.

Bio-printing.

As of the early 2000, 3D printing modern technology has actually been studied by biotech companies and also academia for possible usage in cells design applications where body organs and also body parts are built utilizing inkjet techniques.



Food.

Additive production got into the food market very long time ago. Restaurants like Food Ink and Melisse use this as a distinct marketing indicate attract clients from across the globe.

Education and learning.

Educators and also trainees have actually long been utilizing 3D printers in the classroom. 3D printing allows trainees to materialize their suggestions in a quick as well as budget friendly method.

What is an STL file?

An STL file provides the input information for 3D printing by modeling the surface areas of the object as triangles that share sides as well as vertices with other adjoining triangular for the develop platform.Like other modern technologies and inventions 3D printing is also going to stringer coming industrial revolution 4th.

Artificial intelligence

Prepared By -
Mahbuba Bilkis, Deputy Secretary
Ministry of Labour and Employment

What is Artificial intelligence (AI)?

Artificial intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing

systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—as, for example, discovering proofs for mathematical theorems or playing chess—with great proficiency. Still, despite continuing advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over wider domains or in tasks requiring much everyday knowledge. On the other hand, some programs have attained the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in applications as diverse as medical diagnosis, computer search engines, and voice or handwriting recognition.

What Is Intelligence?

All but the simplest human behaviour is ascribed to intelligence, while even the most complicated insect behaviour is never taken as an indication of intelligence. Intelligence must include the ability to adapt to new circumstances.

Psychologists generally do not characterize human intelligence by just one trait but by the combination of many diverse abilities. Research in AI has focused chiefly on the following components of intelligence:

1.Reasoning

To reason is to draw inferences appropriate to the situation. Inferences are classified as either deductive or inductive. There has been considerable success in programming computers to draw inferences, especially deductive inferences. However, true reasoning involves more than just drawing inferences; it involves drawing inferences relevant to the solution of the particular task or situation. This is one of the hardest problems confronting AI.

2. Problem solving

Problem solving, particularly in artificial intelligence, may be characterized as a systematic search through a range of possible actions in order to reach some predefined goal or solution. Problem-solving methods divide into special purpose and general purpose. A special-purpose method is tailor-made for a particular problem and often exploits very specific features of the situation in which the problem is embedded. In contrast, a general-purpose method is applicable to a wide variety of problems. One general-purpose technique used in AI is means-end analysis—a step-by-step, or incremental, reduction of the difference between the current state and the final goal. Many diverse problems have been solved by artificial intelligence programs. Some examples are finding the winning move (or sequence of moves) in a board game, devising mathematical proofs, and manipulating "virtual objects" in a computer-generated world.

3. Perception

In perception the environment is scanned by means of various sensory organs, real or artificial, and the scene is decomposed into separate objects in various spatial relationships. Analysis is complicated by the fact that an object may appear different depending on the angle from which it is viewed, the direction and intensity of illumination in the scene, and how much the object contrasts with the surrounding field.

At present, artificial perception is sufficiently well advanced to enable optical sensors to identify individuals, autonomous vehicles to drive at moderate speeds on the open road, and robots to roam through buildings collecting empty soda cans.

4. Language

A language is a system of signs having meaning by convention. In this sense, language need not be confined to the spoken word. Traffic signs, for example, form a mini-language, it being a matter of convention that ⊠ means "hazard ahead" in some countries. It is distinctive of languages that linguistic units possess meaning by convention, and linguistic meaning is very different from what is called natural meaning, exemplified in statements such as "Those clouds mean rain" and "The fall in pressure means the valve is malfunctioning." An important characteristic of full-fledged human languages—in contrast to birdcalls and traffic signs—is their productivity. A productive language can formulate an unlimited variety of sentences. At present, artificial perception is sufficiently well advanced to enable optical sensors to identify individuals, autonomous vehicles to drive at moderate speeds on the open road, and robots to roam through buildings collecting empty soda cans.

5. Knowledge and inference

The basic components of an expert system are a knowledge base, or KB, and an inference engine. The information to be stored in the KB is obtained by interviewing people who are expert in the area in question. The interviewer, or knowledge engineer, organizes the information elicited from the experts into a collection of rules, typically of an "if-then" structure.

Synthetic Biology

Prepared By -
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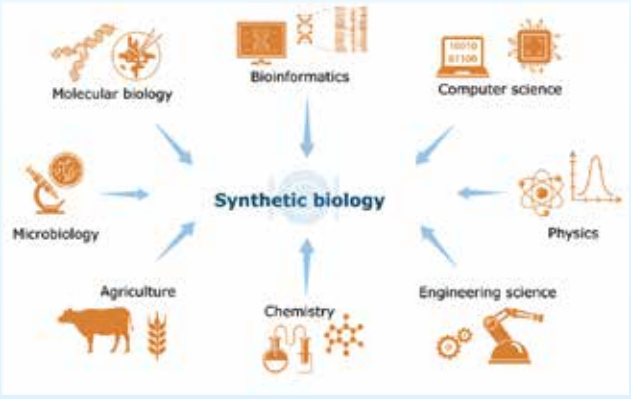
Definition of Synthetic Biology:

Synthetic biology is a field of science that involves redesigning organisms for useful purposes by engineering them to have new abilities. Synthetic biology researchers and companies around the world are harnessing the power of nature to solve problems in medicine, manufacturing and agriculture.

Commission on Genetic Modification (COGEM) defines it as, “design and synthesis of artificial genes and complete biological systems, and changing existing organisms, aimed at acquiring useful functions.



European Commission has a slightly longer definition. “Engineering of biologic components and systems that do not exist in nature, and the re-engineering of existing biologic systems; it is determined on the intentional design of artificial systems, rather than an understanding of natural biology.”

History of Synthetic Biology

1910: First identifiable use of the term "synthetic biology" in Stéphane Leduc's publication Théorie physico-chimique de la vie et générations spontanées. He also noted this term in another publication, La Biologic Synthétique in 1912

1961: Jacob and Monod postulate cellular regulation by molecular networks from their study of the lac operon in E. coli and envisioned the ability to assemble new systems from molecular components.

1973: First molecular cloning and amplification of DNA in a plasmid is published in P.N.A.S. by Cohen, Boyer et al. constituting the dawn of synthetic biology.

1978: Arber, Nathans and Smith win the Nobel Prize in Physiology or Medicine for the discovery of restriction enzymes, leading Szybalski to offer an editorial comment in the journal Gene:

The work on restriction nucleases not only permits us easily to construct recombinant DNA molecules and to analyze individual genes, but also has led us into the new era of synthetic biology where not only existing genes are described and analyzed but also new gene arrangements can be constructed and evaluated.

1988: First DNA amplification by the polymerase chain reaction (PCR) using a thermostable DNA polymerase is published in Science by Mullis et al. This obviated adding new DNA polymerase after each PCR cycle, thus greatly simplifying DNA mutagenesis and assembly.

2000: Two papers in Nature report synthetic biological circuits, a genetic toggle switch and a biological clock, by combining genes within E. coli cells.

2003: The most widely used standardized DNA parts, BioBrick plasmids, are invented by Tom Knight. These parts will become central to the international Genetically Engineered Machine competition (iGEM) founded at MIT in the following year.

2003: Researchers engineer an artemisinin precursor pathway in E. coli.

2004: First international conference for synthetic biology, Synthetic Biology 1.0 (SB1.0) is held at the Massachusetts Institute of Technology, USA.

2005: Researchers develop a light-sensing circuit in E. coli. Another group designs circuits capable of multicellular pattern formation.

2006: Researchers engineer a synthetic circuit that promotes bacterial invasion of tumour cells.

2010: Researchers publish in Science the first synthetic bacterial genome, called M. mycoides JCVI-syn1.0. The genome is made from chemically-synthesized DNA using yeast recombination.

2011: Functional synthetic chromosome arms are engineered in yeast.

2012: Charpentier and Doudna labs publish in Science the programming of CRISPR-Cas9 bacterial immunity for targeting DNA cleavage. This technology greatly simplified and expanded eukaryotic gene editing.

2019: Scientists at ETH Zurich report the creation of the first bacterial genome, named Caulobacter ethensis-2.0, made entirely by a computer, although a related viable form of C. ethensis-2.0 does not yet exist.

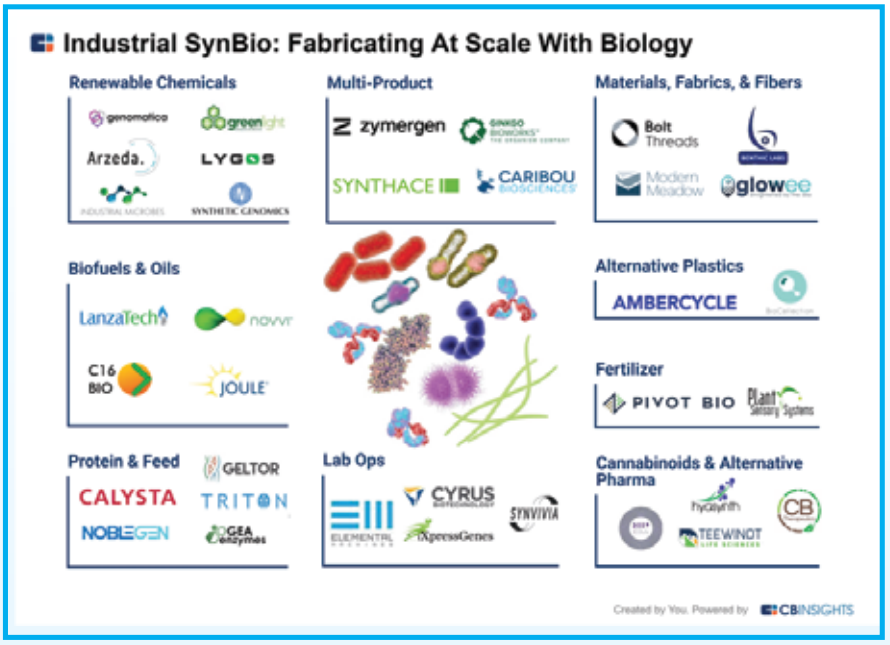
2019: Researchers report the production of a new synthetic (possibly artificial) form of viable life, a variant of the bacteria Escherichia coli, by reducing the natural number of 64 codons in the bacterial genome to 59 codons instead, in order to encode 20 amino acids.

Biotechnology and Synthetic Biology

Biotechnology is a broad term encompassing the application of biological components or processes to advance human purposes. Although the term itself is thought to have been in use for only about a century, humans have used various forms of biotechnology for millennia. Synthetic biology refers to a set of concepts, approaches, and tools within biotechnology that enable the modification or creation of biological organisms.

The exact difference between Synthetic Biology and Biotechnology is this: The Synthetic Biologist tries to make an artificial biologic element (enzyme, piece of DNA etc.) in his lab. Whereas the Biotechnologist tries to isolate the biologic element in its natural form without modifying it. The Biotechnologist does not intervene with nature. If he does then he becomes a Synthetic Biologist.

INDUSTRIAL SYNBIO



- **Renewable Chemicals:** These companies are developing novel methods for the production of basic chemicals used in industrial applications. For example, Genomatica has raised more than $227M to make basic chemicals from renewable sources. Lygos converts low-cost sugars into chemicals such as malonic acid.

- **Biofuels & Oils:** Companies in this category are developing new renewable energy sources. LanzaTech, for example, has enabled microbes to turn waste gases (such as carbon dioxide or methane) into fuels and chemicals. C16 Bio is a YC-backed company synthesizing the environmentally-devastating palm oil that is a common ingredient in many consumer products.

- **Multi-product:** Companies in this category are building solutions for the rapid scaling of custom chemicals. Ginkgo Bioworks and Zymergen both use synthetic biology and lab automation to produce custom chemicals such as synthetic fragrances, nutrition, health, and consumer products.

- **Protein & Feed:** Included companies are commercializing proteins or feedstock products that could be more sustainable than current inputs. Calysta, which counts Cargill as a backer, focuses on proteins for fish and livestock. Geltor works on designing collagen and proteins for cosmetics.

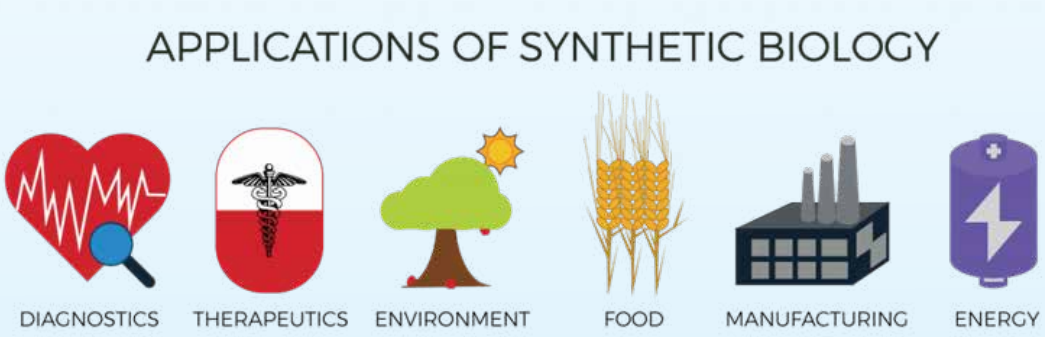
- **Materials, Fabrics, & Fibers:** Companies here are focused on new materials with interesting properties. Bolt Threads, for example, focuses on engineering renewable fibers and fabrics.

- **Lab Ops:** Companies in this category are working on software systems and technologies for industrial biochemistry. One example here is recent Y Combinator graduate Synvivia, which is focused on creating organisms that can be controlled with small molecules. Others like Cyrus Biotechnology work on software for modeling the produced molecules.

- **Cannabinoids & Alternative Pharma:** Companies in this nascent sub-segment are working on synthesizing cannabinoids at scale. Startups such as CB Therapeutics are aiming to develop processes that mass-produce these underlying chemicals.
- **Alternative Plastics:** Ambercycle is working on cell-based alternatives to the many petroleum products including plastics. BioCellection is working on a process to tackle plastic pollution.
- **Fertilizer:** Companies here are working on new fertilizers. Pivot Bio synthesizes nitrogen-rich microbes that get consumed by crops, eliminating the environmental runoff of traditional fertilizers.

Current Uses of Synthetic Biology

Synthetic biology is bringing together engineers and biologists to design and build novel biomolecular components, networks and pathways, and to use these constructs to rewire and reprogram organisms. These re-engineered organisms will change our lives over the coming years, leading to cheaper drugs, 'green' means to fuel our cars and targeted therapies for attacking 'superbugs' and diseases, such as cancer. The de novo engineering of genetic circuits, biological modules and synthetic pathways is beginning to address these crucial problems and is being used in related practical applications.



Naturally Replicating Rubber for Tires

Isoprene is an important commodity chemical used in a variety of applications, including the production of synthetic rubber. Isoprene is naturally produced by nearly all living things (including humans, plants and bacteria); the metabolite dimethylallyl pyrophosphate is converted into isoprene by the enzyme isoprene synthase. But the gene encoding the isoprene synthase enzyme has only been identified in plants such as rubber trees, making natural rubber a limited resource.

Currently, synthetic rubber is derived entirely from petrochemical sources. DuPont, together with The Goodyear Tire & Rubber Company, is currently working on the development of a reliable, high-efficiency fermentation-based process for the Biolsoprene™ monomer, and synthetic biology has played an important role in making this undertaking a reality.

Continued use of synthetic biology should help refine DuPont's biocatalyst for the production of Biolsoprene™ monomer.

Delivering Economic, Renewable BioAcrylic

Acrylic is an important petrochemical used in a wide range of industrial and consumer products. Acrylic ingredients make paints more durable and odor-free, adhesives stronger and longer-lasting, diapers more absorbent and leak-proof, and detergents better able to clean clothes. Today, petroleum-based acrylic is an $8 billion global market.

OPX Biotechnologies (OPXBIO) is developing renewable biobased acrylic to match petro-acrylic performance and cost but with a 75 percent reduction in greenhouse gas emissions. BioAcrylic from OPXBIO also will reduce oil-dependence and offer more stable prices.

Making "Green Chemicals" from Agricultural Waste stronger and longer-lasting, diapers more absorbent and leak-proof, and detergents better able to clean clothes. Today, petroleum-based acrylic is an $8 billion global market.

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Making "Green Chemicals" from Agricultural Waste

Surfactants are one of the most useful and widely sold classes of chemicals, because they enable the stable blending of chemicals that do not usually remain associated (like oil and water).

Today, nearly all surfactants are manufactured from either petrochemicals or seed oils, such as palm or coconut oil. Worldwide production of surfactants from petrochemicals annually emits atmospheric carbon dioxide equivalent to combustion of 3.6 billion gallons of gasoline. Production from seed oil is greener, but there is a limit to the amount of seed oil that can be produced while protecting the rainforest. To address this problem, Modular has developed microorganisms that convert agricultural waste material into useful new surfactants. Dr. P. Somasundaran of the University Center for Surfactants (IUCS) at Columbia University finds that Modular's surfactant is 10-fold more effective than a similar commercially available surfactant.

Today, most organic chemicals are derived from petroleum. Fredrick Frank, Vice Chairman, Peter J. Solomon Company, offers this perspective on the sustainable chemistry industry: "Several published reports have concluded that about two-thirds of those chemicals can be generated from renewable raw materials, rather than from oil. If so, sustainable chemistry potentially has a market size of about $1 trillion. Less than 7 percent of organic chemicals are currently produced from renewable materials, thus there is an opportunity for long-term growth."

Life Technologies Provides a Comprehensive Workflow for Vaccine Development

Demand is growing in developing and developed countries around the world for cost-effective vaccines to prevent infectious diseases. But development of new vaccines is a time-consuming undertaking, requiring the identification of antigens – such as weakened viruses or bacterial toxins or other pathogens – and the development, purification and production of immunogens that might help prevent or treat diseases.

Life Technologies has a proven track record in vaccine development. It provides the molecular engineering tools and services necessary to sequence genetic information to formulate vaccines and other treatments in a more efficient and timely manner than current practices, allowing researchers to save time.

Synthetic biology enables Life Technologies to design, synthesize, test and deploy antigens and variants with rapid results, high expression and capacity. It also enables Life Technologies to develop immunogens engineered for efficacy and high titer and produce rapid assays for purification of the immunogens.

Life Technologies scientists developed the custom gene constructs that serve as the basis for HIV vaccine candidates. The gene sequences were custom-designed by scientists at GeneArt® – which merged with Life Technologies in December 2010 – and the University of Regensburg, and then tested in a phase I clinical trial by the EuroVacc Foundation. The trial proved the prophylactic vaccine to be safe and well tolerated, triggering a strong and lasting immune response in 90 percent of the candidates. Additional trials are ongoing. In 2009, GeneArt was awarded a contract by the HIV Vaccine Consortium (UK) to design and produce two HIV vaccine candidates based on the HIV gene sequences used in the 2008 trial.

In May 2009, the GeneArt gene synthesis and assembly platform was employed to create synthetic H1N1 genes, and the product was delivered within a 5-day period. GeneArt created an additional ten H1N1 viral coat protein constructs for the Robert Koch Institute (the central federal institution responsible for disease control and prevention in Germany).

Developing a Suite of Biobased Products and Services

DSM, a Life Sciences and Materials Sciences company headquartered in the Netherlands, was one of the first companies to utilize synthetic biology, dramatically improving an existing process for commercial production of Cephalexin, a synthetic antibiotic. Starting with a penicillin-producing microbial strain, DSM introduced and optimized two enzyme-encoding genes for a one-step direct fermentation of adipoyl-7-ADCA, which could then be converted into Cephalexin via two enzymatic steps. The new process replaced a 13-step chemical process, resulting in significant cost and energy savings. DSM has gone on to build a business in antibiotics, vitamins, enzymes, organic acids, and performance materials within one of its emerging business areas called Biobased Products and Services. Major biotechnology advances are opening up opportunities in the production of biofuels and renewable chemicals as well as materials made from different types of renewable biomass. Recent DSM breakthroughs include a cocktail of enzymes that break down the lignocellulose from agricultural residues to simple C5 and C6 sugars.

Advances in synthetic biology have enabled DSM to develop recombinant yeast capable of co-fermenting both hexoses and pentoses.

DSM introduced enzymes from native xylose-assimilating organisms to S. cerevisiae, allowing co-fermentation of xylose and arabinose along with glucose. Recently DSM announced a 50/50 joint venture with a major ethanol producer, POET for the commercial development, demonstration and licensing of cellulosic bio-ethanol.

In summary, DSM's long track record in anti-infectives and vitamins combined with an ever growing experience base in synthetic biology have strengthened DSM's overall capabilities to work with partners and industry stakeholders along the emerging value chains.

Engineering Low-Cost Sugars for Petroleum Substitute

Sugars from non-food biomass can be used as building blocks to manufacture a wide variety of biofuels and renewable chemicals that are currently produced from expensive and price-volatile petroleum feedstocks. The advanced biofuels market is estimated to grow to 21 billion gallons by 2022, based on the U.S.

Renewable Fuels Standard (RFS) under the Energy Independence and Security Act of 2007.

Traditional sugar fermentation processes to produce biofuels and renewable chemicals use either sucrose from sugarcane or starch from corn, sorghum, or wheat. Agrivida's engineered biomass provides greater price stability for raw materials, uses less energy in producing biofuels and renewable chemicals via fermentation and enables production with dramatically lower greenhouse gas emissions.

Creating Economic Advantage for a Commonly Used Chemical

Adipic acid is a valuable chemical intermediate used in production of nylon for well-established markets like automotive parts, footwear, and construction materials. The current market for adipic acid is approximately $5.2 billion. Current petrochemical processes for the production of adipic acid generate as much as 4.0 tons of CO2 equivalents per ton of adipic acid produced. A biobased process could reduce the production costs of adipic acid by 20 percent or more.

Verdezyne is developing a cost-advantaged, environmentally friendly fermentation process for adipic acid. The company's proprietary metabolic pathway can utilize sugar, plant-based oils or alkanes, and the company has completed proof-of-concept testing for fatty acids and alkanes. The potential benefit of this feedstock flexible approach is the ability to maintain a sustainable economic advantage regardless of future energy volatility and to reduce the environmental footprint for producing adipic acid.

Adipic acid is not produced in nature. Verdezyne's novel combinatorial approach to pathway engineering rapidly creates and harnesses genetic diversity to optimize a metabolic pathway. Rather than manipulating one pathway gene at a time, the company uses synthetic gene libraries to introduce diversity into a metabolic pathway. The company's unique computational and synthetic biology toolbox allows effective design, synthesis and expression of synthesized genes in a heterologous recombinant yeast microorganism.

Producing Biofuels and Renewable Chemicals as Petroleum Alternatives

Diesel is the most widely used liquid fuel in the world. This energy dense fuel supports the transport of 70 percent of U.S. commercial goods and is in high demand in the developing world to support the heavy equipment (trucks, bulldozers, trains, etc) required for infrastructure development. Today there is no cost-effective renewable alternative to diesel.

LS9 has developed a platform technology that leverages the natural efficiency of microbial fatty acid biosynthesis to produce a diversity of drop-in fuels and chemicals. Using synthetic biology, LS9 has developed microbial cells that can perform a one-step conversion of renewable carbohydrates (sugars) to two diesel alternatives, a fatty acid methyl ester (biodiesel ASTM 6751) and an alkane (ASTM D975).

Synthetic biology has been essential in engineering the LS9 microbial catalysts. The biosynthetic pathways to produce finished fuel products do not exist in the native E. coli host, and prior to our efforts alkane biosynthetic genes were unknown. LS9 designed the pathways, synthesized the genes encoding each enzyme in the pathway, and constructed multigene biosynthetic operons enabling production.

Increasing Rates of Natural Fermentation for Polymers

Metabolix is bringing new, clean solutions to the plastics, chemicals and energy industries based on highly differentiated technology. For 20 years, Metabolix has focused on advancing its foundation in polyhydroxyalkanoates (PHA), a broad family of biopolymers. Through a microbial fermentation process, the base polymer PHA is produced within microbial cells and then harvested. Development work by Metabolix has led to industrial strains of the cells, which can efficiently transform natural sugars into PHA. The recovered polymer is made into pellets to produce Mirel™ Bioplastics by Telles products.

Conventional plastics materials like polyvinyl chloride (PVC), polyethylene teraphthalate (PET), and polypropylene (PP) are made from petroleum or fossil carbon. The PHA in Mirel bioplastics is made through the fermentation of sugar and can be biodegraded by the microbes present in natural soil or water environments. Although PHAs are produced naturally in many microorganisms, the cost and range of compositions required for successful commercialization dictated that PHA pathways had to be assembled in a robust industrial organism that does not naturally produce the product.

Metabolic pathway engineering was used to accomplish this task, relying on modern tools of biotechnology.

Increasing Efficiency in Bioprocessing of Pharmaceuticals

Sitagliptin, Merck's first-in-class dipeptidyl peptidase-4 inhibitor, is marketed under the trade name Januvia® as a treatment for type II diabetes. The chemical manufacturing route to Sitagliptin developed by Merck won a Presidential Green Chemistry Challenge Award in 2006, but there were still several opportunities for improvement. Codexis and Merck collaborated to develop a novel, environmentally benign alternative manufacturing route. Using synthetic biology and its directed evolution technologies, Codexis discovered and developed a transaminase capable of enabling the new biocatalytic route, which is currently in scale-up towards commercial manufacture.

One common definition of "synthetic biology" is "the design and construction of new biological entities that do not exist in the natural world." In this instance, there was no known enzyme that could perform the reaction required to enable the biocatalytic route. By designing and generating new enzyme variants, Codexis was able to identify a novel enzyme that provided detectable initial activity. This enzyme was then improved greater than 25,000-fold in order to generate the highly active, stable, enantioselective and practical enzyme from a starting activity that did not previously exist in the natural world. This work was awarded with the Presidential Green Chemistry Challenge Award in June, 2010.

Conclusion:

So, to summarize: medicine, energy, industry, art, fashion, the environment every part of our world is touched by livings things and might be affected by synthetic. Some people are super excited about this, they think it's the best new thing since computer. Other's people think that it is very dangerous that if we screw this up it means a disaster that can never be fixed. But either way this is a technology that people need to know about.

Cloud Technology

Prepared By -
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Ministry of Labour and Employment

What is Cloud Technology?

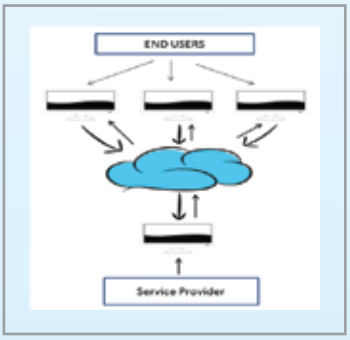
Cloud Technology may be defined as storing and accessing of data and computing services over the internet. It doesn't store any data on our personal computer. It is the on-demand availability of computer services of the following:

- ⇨ servers,
- ⇨ data storage,
- ⇨ networking,
- ⇨ databases, etc.

The main purpose of cloud technologies is to give access to data centers to many users. Users can also access data from a remote server.

Examples of Cloud Technology based Services:

amazon web services	Amazon Web Services
Microsoft Azure	Microsoft Azure
	Google Cloud
	Gmail
	Facebook
twitter	Twitter



Why the Name Cloud?

The term “Cloud” came from a network design that was used by network engineers to represent the location of various network devices and their inter-connection. The shape of this network design was like a cloud.

History of Cloud Technology:

The term cloud computing itself coined in 1996 within a Compaq internal document. The term cloud was used to refer to platforms for distributed computing as early as 1993,Cloud computing was popularized with Amazon.com releasing its Elastic Compute Cloud product in 2006.

Benefits of Cloud Technologies:

The potential for cost saving is the major reason of cloud services adoption by many organizations. Following are the other benefits of cloud computing:

1. Lower IT infrastructure and computer costs for users
2. Improved performance
3. Fewer Maintenance issues
4. Instant software updates
5. Improved compatibility between Operating systems
6. Backup and recovery
7. Performance and Scalability
8. Increased storage capacity
9. Increase data safety

How do we access to cloud technologies?

We access to the cloud technology to store and retrieve information over the internet by using web browser like Google Chrome, Mozilla Firefox etc.

Types of Clouds:

There are four different cloud models according to business needs. Following are the different Types of Clouds:

1. Private Cloud: Here, computing resources are deployed for one particular organization. This method is more used for intra-business interactions. Where the computing resources can be governed, owned and operated by the same organization. It is also known as internal cloud or Corporate Cloud.

Example: HP Data Centers, Microsoft, Elastra Private Cloud and Ubuntu.

2. Community Cloud: Here, computing resources are provided for a community and organizations with common concerns whether managed internally or by a third party and hosted internally or externally.

Example: Google Apps for Government, Microsoft Government Community Cloud.

3. Public Cloud: Cloud services are considered public when they are delivered to the public over the internet as a paid subscription or free of charge.Mostpublic cloud providers offerdirect connection services that allow customers to securely link their legacy data centers to their cloud resident application.

Example: Amazon Elastic Cloud Computer (EC2), Google App Engine, Blue Cloud by IBM and Azure Platform Services by Windows.

4. Hybrid Cloud: A Cloud Computing environment which uses a mix of on premises private cloud and third-party public cloud services. This type of cloud can be used for both type of interactions - B2B (Business to Business) or B2C (Business to Consumer)

Example: Google Drive, Amazon Web Services, Microsoft Azure

Cloud Computing Services:

The three major Cloud Computing Offerings are

1. Software as a Service (SaaS)
2. Platform as a Service (PaaS)
3. Infrastructure as a Service (IaaS)

1)SaaS (Software as a Service):

SaaS or software as a service is a software distribution model in which cloud provider leases applications or software which are owned by them to its client. It is usually priced on a pay-per-use basis or using a subscription fee. SaaS is compatible with all internet enabled devices.

Example: Gmail, Twitter, You Tube,Google Workspace, Dropbox, Salesforce,Cisco Webex,Concur, Go to Meeting.

2) PaaS (Platform as a Service):

Platform as a service, is referred as PaaS, it provides a platform and environment to allow developers to build applications and services. This service is hosted in the cloud and accessed by the users via internet. PaaS services are constantly updated & new features added. Software developers, web developers and business can benefit from PaaS.

Example: Facebook, Amazon Web Service Elastic, Beanstalk, Windows Azure, Heroku, Google App Engine, Apache Stratos, Open Shift.

3)IaaS (Infrastructure as a Service):

It provides access to computing resources in a virtualized environment “the cloud” on internet. It provides computing infrastructure like virtual server space, network connections, bandwidth, load balancers and IP addresses. The pool of hardware resource is extracted from multiple servers and networks usually distributed across numerous data centers.

Examples: Digital Ocean, Linode,Rackspace, Amazon Web Services, Cisco Metal Cloud, Microsoft Azure,Google Compute Engine GCE

Limitations of Cloud Technologies:

1)Privacy Concerns:

Cloud computing poses privacy concerns because the service provider can access the data that is in the cloud at any time. It could accidentally or deliberately alter or delete information many cloud providers can share information with third parties if necessary for purposes of law and order without a warrant. That is permitted in their privacy policies, which users must agree to before they start using cloud services.

2)Data Loss and Leakage:

In a cloud provider platform being shared by different users, there may be a possibility that information belonging to different customers resides on the same data server. Hackers are spending substantial time and effort looking for ways to penetrate the cloud.

3) Problem of legal ownership of Data:

Many Terms of Service agreements are silent on the question of ownership. There is the risk that end users do not understand the issues involved when signing on to a cloud service person sometimes don't read the many pages of the terms of service agreement, and just click "Accept" without reading.

4) Technical Outage:

Technical outages are inevitable and occur sometimes when cloud service providers (CSPs) become overwhelmed in the process of serving their clients. This may result in temporary business suspension. Since this technology's systems rely on the Internet, an individual cannot access their applications, server or data from the cloud during an outage

Issues of cloud technologies for policy makers of Bangladesh:

1) Invest on It Human Resources to advent the opportunity of cloud technology at a low cost.

2) Adopt appropriate policy and legislation to protect the privacy of Bangladeshi nationals.

3) Invest on technology and manpower to cope with cybercrime.

4) A win to win negotiation with cloud providers ie to negotiate with Facebbok to pay VAT and Taxes for facebook advertising.

5) To supply latest internet technology ie 5G Internet

Autonomous vehicle

Prepared By -
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We are moving towards an age of autonomous vehicles. This is not an overnight development; but has been ongoing for decades. The vision for autonomous vehicles is ambitious and compelling. It may sound like science fiction rather than a real development that could happen in our lifetimes. Yet, the possibility exists that we will see fully autonomous vehicles on roads in a scant few decades (or years). A radical reduction in the number of fatalities, injuries, and property damage due to crashes is a huge motivating factor in the realization of the autonomous vehicle. According to National Highway Traffic Safety Administration of U.S, Motor vehicle crashes are the leading cause of death for ages 11-27, and over 32,000 people are killed each year in crashes. Additionally, there are over two million crashes with injuries and over three million crashes with property damage. On average, one person is killed every 16 minutes in a vehicle crash. Moreover, crash causation studies reveal that 93% of all crashes are attributable to driver error. Hence, the development of artificial intelligence and real-time data processing technologies have enabled the introduction of autonomous vehicles as a revolutionary concept for future days.

What is an autonomous vehicle?

(AVs), also known as self-driving cars or driverless cars are vehicles that can drive without the aid of a human operator.An autonomous vehicle, or a driverless vehicle, is one that is able to operate itself and perform necessary functions without any human intervention, through ability to sense its surroundings. An autonomous vehicle utilizes a fully automated driving system in order to allow the vehicle to respond to external conditions that a human driver would manage.

6 Levels of Autonomous Vehicles

There are six different levels of automation and, as the levels increase, the extent of the driverless car's independence regarding operation control increases.

At level 0, the car has no control over its operation and the human driver does all of the driving.

At level 1, the vehicle's ADAS (advanced driver assistance system) has the ability to support the driver with either steering or accelerating and braking.

At level 2, the ADAS can oversee steering and accelerating and braking in some conditions, although the human driver is required to continue paying complete attention to the driving environment throughout the journey, while also performing the remainder of the necessary tasks.

At level 3, the ADS (advanced driving system) can perform all parts of the driving task in some conditions, but the human driver is required to be able to regain control when requested to do so by the ADS. In the remaining conditions, the human driver executes the necessary tasks.

At level 4, the vehicle's ADS is able to perform all driving tasks independently in certain conditions in which human attention is not required.

Finally, level 5 involves full automation whereby the vehicle's ADS is able to perform all tasks in all conditions, and no driving assistance is required from the human driver. This full automation will be enabled by the application of 5G technology, which will allow vehicles to communicate not just with one another, but also with traffic lights, signage and even the roads themselves.

Currently, vehicles are only partly autonomous (level 2), capable of, for instance, autonomous parking. However, vehicle companies, including Ford, Honda, Toyota, Nissan, Volvo, Hyundai, Daimler, Fiat-Chrysler, and BMW increase investments in the development of autonomous vehicles

One of the aspects of the vehicle technology used in automated vehicles is ACC, or adaptive cruise control. This system is able to adjust the vehicle's speed automatically to ensure that it maintains a safe distance from the vehicles in front of it. This function relies on information obtained using sensors on the vehicle and allows the car to perform tasks such as brake when it senses that it is approaching any vehicles ahead. This information is then processed and the appropriate instructions are sent to actuators in the vehicle, which control the responsive actions of the car such as steering, acceleration and braking. Highly automated vehicles with fully automated speed control are able to respond to signals from traffic lights and other such non-vehicular activities.

Basic Physical Ecosystem of an Autonomous Vehicle

- Global Positioning System (GPS)
- Light Detection and Ranging (LIDAR)
- Cameras (Video)
- Ultrasonic Sensors
- Central Computer
- Radar Sensors
- Dedicated Short-Range Communications-Based Receiver

What are the Advantages?

Autonomous vehicle technology may be able to provide certain advantages compared to human-driven vehicles. One such potential advantage is that they could provide increased safety on the road – vehicle crashes cause many deaths every year, and automated vehicles could potentially decrease the number of casualties as the software used in them is likely to make fewer errors in comparison to humans which is the cause of 93% crashes in the U.S. Secondly, due to better route planning and more efficient operation, AVs are predicted to reduce road congestion by the removal of human behaviors that cause blockages on the road. It reduces fuel emission and fuel economy as well as improve pavement stability Thirdly, what may be important for consumers is the ability of AVs to save time and provide comfort and leisure, as they allow the passengers to engage in non-driving activities.

Another possible advantage of automated driving is that people who are not able to drive – due to factors like age and disabilities – could be able to use automated cars as more convenient transport systems. Additional advantages that come with an autonomous car are elimination of driving fatigue and being able to sleep during overnight journeys.

Challenges of Autonomous vehicles:

Introduction of AVs is connected with multiple challenges such as safety, legal liability, ethical questions, personal injury, Cybersecurity and data breaches, intellectual property ownership and regulatory issues, which result in consumers' fear towards this tech. AVs also are a challenge to the traditional role of drivers and driving pleasure. Even though the benefits of AVs seem to significantly outweigh the risks associated with them, consumer acceptance of this technology is still uncertain. It is, however, crucial for its diffusion and commercial success. While many studies concerning attitudes towards AVs were conducted, the results are mixed. Some found that the positive attitude prevails, while other show the contrary.

Some recent developments on Autonomous vehicle:

In, January 2017 – Keolis and NAVYA, in partnership with the city of Las Vegas, launched the first autonomous, fully electric shuttle to be deployed on a public roadway in the United States. January 2018 – Toyota announces "e-Palette" concept vehicle which is a fully electric autonomous vehicle that can be customized by a partner for applications such as food deliveries (Pizza Hut), ride-sharing (Uber), or store fronts (Amazon). • January 2018 – Udelv, a Bay Area tech company, completed the first delivery of goods by a self-driving car when it delivered groceries in San Mateo. • February 2018 – Hyundai announced that a fleet of its fuel cell electric cars made a successful fully automated trip from Seoul to Pyeongchang. This is the first time a Level 4 car has been operated with fuel cell electric cars. It is estimated that 10 million autonomous vehicles will hit the roads by 2022. In 10 years fully autonomous vehicles will be the norm. AVs will generate a $7 trillion annual revenue stream by 2050. Widespread adoption of AVs could lead to a 90% reduction in vehicle crashes.

Blockchain

Prepared By -
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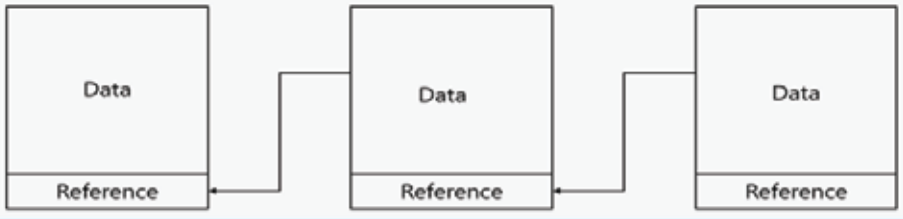
What is A Blockchain?

A blockchain is a growing list of data blocks that are linked together.



Blockchain's key features

Types of Blockchain

1. Public Blockchain: A public blockchain is a non-restrictive, permission-less distributed ledger system. Anyone who has access to the internet can sign in on a blockchain platform to become an authorized node and be a part of the blockchain network.The most basic use of public blockchains is for mining and exchanging cryptocurrencies. Example: Bitcoin, Ethereum, Litecoin

2. Private Blockchain: A private blockchain is a restrictive or permission blockchain operative only in a closed network. Private blockchains are usually used within an organization or enterprises where only selected members are participants of a blockchain network. Private blockchain networks are deployed for voting, supply chain management, digital identity, asset ownership, etc. examples of private blockchains are; Multichain and Hyperledger projects (Fabric, Sawtooth), Corda, etc

3. Consortium Blockchain: A consortium blockchain is a semi-decentralized type where more than one organization manages a blockchain network. Examples of consortium blockchain are; Energy Web Foundation, R3, etc.

4. Hybrid Blockchain: A hybrid blockchain is a combination of the private and public blockchain. It uses the features of both types of blockchains that is one can have a private permission-based system as well as a public permission-less system. Example of a hybrid block chain is Dragonchain.

Block chain in legal

"Smart contracts" stored on the blockchain track contract parties, terms, transfer of ownership, and delivery of goods/ services without legal intervention.

Block chain in supply chain

By utilizing a distributed ledger, companies within a supply chain gain transparency into shipment tracking, deliveries, and progress and among other suppliers where no inherent trust exists.

Streamlining the supply chain with smart contracts

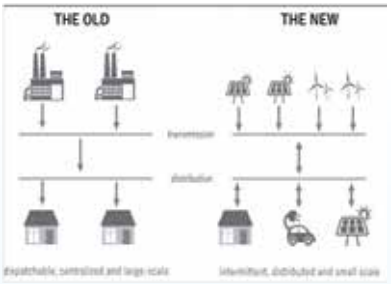
These contracts are incredibly difficult to tamper with thanks to the cryptography-based transactions of Blockchain.

Blockchain in Education

Educational institution could utilize the blockchain to store credentialing data around assessments, degrees, and transcripts eliminating chance of loss of result flip.

Blockchain In energy

Decentralized energy transfer and distribution are possible via micro-transactions of data sent to blockchain validated, and re-dispersed to the grid while securing payment through the submitter.



Block chain in food

Using blockchain to store food supply chain data offers enhanced traceability of product origin, batching, processing, expiration, storage temperatures, and shipping.

Blockchain in government

Block chain offers promise as a technology to store personal identity information, criminal backgrounds, and E-citizenship authorized by biometrics.

Block chain in Healthcare

Electronic medical records stored in a blockchain, accessed and updated via biometrics, allow for the democratization of patient data and alleviate the burden of transferring records among providers.

Block chain in travel and Hospitality

Passengers stored there authenticated single travel ID on the blockchain for use in Lieu of travel documents identification cards loyalty program ids, and payment data

Block chain insurance

When autonomous vehicles and other devices communicate the status updates with insurance providers via the blockchain, premium costs decrease as the need for auditing and authenticating data Vanishes.

Micro level goods tracking and efficiency

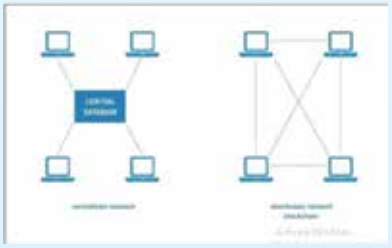
Blockchain dramatically enhances transparency, enabling all parties to trace a products journey along the supply chain.

Tracing the provinces and supply chain journey of individual packages of produce, enables pinpoint and prevention of outbreaks and illness.

Block chain in retail

Secure p2p marketplaces can track p2p retail transactions, with product information, shipment, and bills of lading input on the blockchain, and paying via Bitcoin

Implementing block chain



Developers are experimenting with retail processes and applications on a flexible, scalable and trusted cloud platform.

Revolutionizing retail supply chain efficiency with rapid, low-cost, low-risk, and fast- fail platforms that enable developers to experiment with a growing number of distributed ledger technologies.

Advantages and Disadvantages of Blockchain

Pros

- Improved accuracy by removing human involvement in verification
- Cost reductions by eliminating third-party verification
- Decentralization makes it harder to tamper with
- Transactions are secure, private, and efficient
- Transparent technology
- Provides a banking alternative and way to secure personal information for citizens of countries with unstable or underdeveloped governments

Cons

- Significant technology cost associated withMining bitcoin
- Low transactions per second
- History of use in illicit activities
- Regulation

Public blockchain systems: Bangladesh perspective

Even though there are different ways public blockchain systems can be utilised, crypto-currency still remains the most widely used application not only in public blockchain domain, but also for the whole blockchain domain in general. Bitcoin is the mostly wide-used crypto-currency so far, however, Ethereum, the world's first fully-fledged smart-contract platform, provides exciting propositions. It is in fact Ethereum that is leading the innovation in the public blockchain domain and is being explored in a multitude of application areas.

Unfortunately, Ethereum and other public blockchain-based smart-contract platforms heavily rely on their underlying crypto-currencies. One major concern, particularly in the governments throughout the world, for these crypto-currencies is their support for pseudonymous or even fully anonymous payment mechanisms. Such mechanisms, being untraceable to a legal entity, often are abused by criminals for a wide range of criminal activities. Because of this, many governments remain extremely cautious for adopting any public blockchain system. Bangladesh, like a few other countries, have explicitly banned the usage of Bitcoin and other crypto-currencies in Bangladesh.

Despite all these negativities, public blockchain domain is considered one of the very few domains with strong disrupting capabilities. This is indicated by the amount of investments attracted by this domain. A recent study reports that (mostly public) blockchain start-ups have managed to raise a huge 23 Billion USD of investments since 2013 [6] which is expected to grow in the future. These investments are used in legitimate existing propositions aiming to disrupt many existing application domains. There is an opportunity for Bangladeshi software industries to grab a certain portion of these investments. Banning the usages of any crypto-currency ultimately prevents our software industries to explore this lucrative domain. We also understand that, without a proper technical, legal and policy framework in place, opening up this domain might open up the door of many hard-to-tackle criminal activities. Therefore, we should adopt a "curious-but-cautious" approach and explore how this dilemma can be effectively tackled.

Blockchain Agendas of Bangladesh

With an impressive track record for growth and development, Bangladesh is marching forward to become a higher middle-income country in the next few years and have become a role model for growth and development for the whole world. However, Bangladesh still faces a lot of challenges that need to be effectively addressed to continue its tremendous growth to achieve the SDG goals by 2030 and become a developed nation by 2041. It is undeniable that the proper usage of cutting-edge technology, such as blockchain technology, will play a significant role to meet these challenges.

"SDG 9: Build a resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"

- Technological Visions
- Develop resilient infrastructure
- e-Governance
- Promote innovation
- Facilitate fair competition
- Reduce intermediary
- Ensure accountability and transparency
- Increase trust
- Guarantee information security and privacy
- Involve all stakeholders

Pathway to a blockchain-enabled nation

The Fourth Industrial Revolution demands a technology-infused paradigm and cultural shift in societies. It will create new models of economy and business and unprecedented value propositions. All these can be pursued only with right preparations and accessed only with proper technologies. Blockchain technology being a foundational technology for the upcoming fourth industrial revolution, Bangladesh must prepare herself to embrace it wholeheartedly. In this document, we lay down our ambition towards a blockchain-enabled nation where every aspect of the government is one way or another integrated and managed with a blockchain system as to create a corruption free, transparent and accountable society. Next, we explore the challenges we might face and present a pathway towards realising this dream.

Challenges

Technical challenges: Immaturity, Vendor lock-in, Scalability, Privacy, Lack of interoperability/compatibility, Lack of technical expertise, Support infrastructure, Usability.

Organizational challenges: Lack of awareness, Organizational acceptability & readiness, Governance, Lack of regulatory framework, Legal Issues, Integration with legacy systems, Business model transformation, Risk estimation.

Conclusion

The Fourth Industrial Revolution will entirely depend on a few cutting-edge technologies. This revolution will introduce new challenges as well as exciting opportunities. Tackling these challenges and exploiting the opportunity will solely rely on the effective usage of these emerging technologies. Countries who are better equipped and prepared to embrace these emerging technologies will have a greater chance of success in this upcoming revolution. Blockchain is often considered as the foundational technology for this revolution. Realising its potential, many countries around the world are exploring the ways blockchain technology can be effectively leveraged.

It is important to realise this is an extremely fast-moving domain where technologies are changing at an unprecedented rate. Therefore, we must act fast, otherwise, we may not be able to prepare ourselves for the fourth industrial revolution in due time. We hope that this document will be the perfect start to accelerate our journey towards a blockchain-enabled nation and to prepare us for an exciting time ahead.

Robotics

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Introduction & History of Robotics

Robotics is the intersection of science, engineering and technology that produces machines, called robots that substitute for human actions. Pop culture has always been fascinated with robots.

The earliest robot as we know there were created in 1950's by George C.Devol, an inventor from Louisville, Kentucky. He invented an patented a reprogrammable manipulator called "Unimate" from "Universal" automations.

Although the science of robotics only came about in the 20th century, the history of robots and human-invented automation has a much lengthier past. In fact, the ancient Greek engineer Hero of Alexandria produced two texts, Pneumatica and Automata, that testify to the existence of hundreds of different kinds of "wonder" machines capable of automated movement.

ASIMO, The Coolest Robot in the world!

ASIMO is a humanoid robot created by Honda in 2000. Since then it has been continually developed and has become one of the worlds most advanced social robots.

Types of Robots

Generally, there are five types of robots:

Pre-Programmed Robots:

Pre-programmed robots operate in a controlled environment where they do simple, monotonous tasks. An example of a pre-programmed robot would be a mechanical arm on an automotive assembly line.

Humanoid Robots:

Humanoid robots are robots that look like and/or mimic human behavior. These robots usually perform human-like activities (like running, jumping and carrying objects), and are sometimes designed to look like us, even having human faces and expressions. Two of the most prominent examples of humanoid robots are Hanson Robotics' Sophia and Boston Dynamics' Atlas.

Autonomous Robots:

Autonomous robots operate independently of human operators. These robots are usually designed to carry out tasks in open environments that do not require human supervision. An example of an autonomous robot would be the Roomba vacuum cleaner, which uses sensors to roam throughout a home freely.

Teleoperated Robots:

Teleoperated robots are mechanical bots controlled by humans. These robots usually work in extreme geographical conditions, weather, circumstances, etc.

Augmenting Robots:

Augmenting robots either enhance current human capabilities or replace the capabilities a human may have lost. Some examples of augmenting robots are robotic prosthetic limbs or exoskeletons used to lift hefty weights.

Advantages of Robotics

- Safety: Safety is the most obvious advantage of utilizing robotics. Heavy machinery, machinery that runs at hot temperature, and sharp objects can easily injure a human being. By delegating dangerous tasks to a robot, you're more likely to look at a repair bill than a serious medical bill or a lawsuit. Employees who work dangerous jobs will be thankful that robots can remove some of the risks.

- Speed: Robots don't get distracted or need to take breaks. They don't request vacation time or ask to leave an hour early. A robot will never feel stressed out and start running slower. They also don't need to be invited to employee meetings or training session. Robots can work all the time, and this speeds up production. They keep your employees from having to overwork themselves to meet high pressure deadlines or seemingly impossible standards.
- Perfection: Robots will always deliver quality. Since they're programmed for precise, repetitive motion, they're less likely to make mistakes. In some ways, robots are simultaneously an employee and a quality control system. A lack of quirks and preferences, combined with the eliminated possibility of human error, will create a predictably perfect product every time.
- Job Creation: Robots don't take jobs away. They merely change the jobs that exist. Robots need people for monitoring and supervision. The more robots we need, the more people we'll need to build those robots. By training your employees to work with robots, you're giving them a reason t o stay motivated in their position with your company. They'll be there for the advancements and they'll have the unique opportunity to develop a new set of tech or engineering related skills.
- Productivity: Robots can't do everything. Some jobs absolutely need to be completed by a human. If your human employees aren't caught up doing the things that could have easily be left for robots, they'll be available and productive. They can talk to customers, answer emails and social media comments, help with branding and marketing, and sell products. You'll be amazed at how much they can accomplish when the grunt work isn't weighing them down

While we're still lightyears away from a fully robotic workplace, the robotic capabilities that many companies are currently utilizing have proven to be one of the greatest innovations of our time. Start by adding a few robots, and see where it takes you.

Why is Robotics Important?

Robotics technology influences every aspect of work and home. Robotics has the potential to positively transform lives and work practices, raise efficiency and safety levels and provide enhanced levels of service. In these industries robotics already underpins employment

Disadvantages of Robotics

- They lead humans to lose their jobs: Robots have a bad habit of taking peoples' jobs. I mean, in a capitalist system business owners have to do what it takes to maximize profits. And the brutal efficiency of robots makes them perfect for the task. Humans just can't compete with a robot that can work 24/7 without making any mistakes. That fact can force people out of jobs they've done their entire lives.
- They need constant power: Robots need oodles of electricity to run. That makes them expensive to run and potentially damaging to the environment.
- They have no emotions: Robots don't feel anything either. They're machines- clever chunks of metal with gears and keeping them 'alive'. But they could never feel any emotion that would allow them to empathies with, or relate to, what we're going through. You could never sit down and have a heart to heart with a robot.

- They perform relatively few tasks: In a similar way, robots are only suited, as of now, for specific roles and responsibilities. They come into their own in industry, research, medical practices, and the military. Outside of those domains, though, they have minimal practical usage. Our day to day lives are slowly becoming more robot-centric. For now, though, there's a way to go before we start putting robots to work around the house at scale.
- They're expensive to install and run: Business owners looking to install robots in their facto ries/operations face significant upfront costs. After all, robots aren't cheap- especially when t hey're high-tech, top of the line and needed for a specific task. The can put extreme financial pressure on an organization.
- They cause cybersecurity issues: Robots open the door to a range of cybersecurity problems too. Even today, the rise of computers leaves many organizations and individuals open to attack. Hacks, ransomware, and identity theft are all potential hazards. Now, fast forward a few decades to a time when robots are an everyday part of life. They might be helping out around the house, caring for peoples' wellbeing, and running any number of key tasks. Imagine if somebody hacked their system and programmed them to 'misbehave'.

How Robotics will change the world with automation?

Robots are changing the world by helping humans do things better (with greater efficiency) and doing things that were not possible before. Robots facilitate disaster response, augment physical abilities, serve in areas where interaction with people is needed, and enable exploration beyond the boundaries of Earth.

From Labor to Automation

Coupled with artificial intelligence and the internet of things, automation has become a key necessity in the 4th industrial revolution, automating complex processes which were once only possible through humans. And as the tides change throughout the world with the new developments in technology and remaking of global supply chains due to the US China trade war, labor intensive industries like the apparel industry are likely to be hit the hardest by new developments.

AUTOMATION TO REPLACE 60% RMG JOBS BY 2041

As many as 60 percent of the jobs in the readymade garment (RMG) sector will become automated by 2041, which in effect will make nearly two out of every five employees jobless in the industry.

Female employees with low education, and workers in low-wage positions, will be at a higher risk of losing their jobs because of automation.

The process will create additional employment opportunities for skilled workers in the emerging field. However, Bangladesh currently lags behind in producing workers with necessary skills such as computer aided process planning and quality control.

FUTURE OF AUTOMATION IN RMG SECTOR OF BANGLADESH

Big changes are afoot in the RMG sector as automation in the industry is gaining traction. Experts opine that in the short run there is not much to worry about, however, in the long run, Bangladesh has to adapt to the changes.

Right now, it is a need for the times to pre plan and prepare for the automation shift in the garments sector. Automation would ensure quality and cost-effective production and ultimately it would bring a positive impact in the national economy.

However, several things must be kept in mind. Firstly, we must consider whether or not it would be viable. We should take into account the high cost of machines, operation and maintenance and capability of owners.

Another factor we must consider is the plight of garment workers. Already they are paid minimum wage, but with the rise of automation, they will likely lose their livelihood.

Robots already play a pivotal role in society. You can guarantee that they'll be a major part of society in future too. Heck, one day they might even rise up and overthrow us. Until then, though, we can enjoy the many advantages of robots on offer, while keeping a close eye on the disadvantages of robots too

Augmented Reality

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What is Augmented Reality?

Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.

AR can be defined as a system that fulfills three basic features:

- a combination of real and virtual worlds,
- Real-time interaction, and
- Accurate 3D registration of virtual and real objects.

History of Augmented Reality

Augmented reality technology was invented in 1968, with Ivan Sutherland's development of the first head-mounted display system. 1990: Tom Caudell, a Boeing researcher, coined the term 'augmented reality'.

Technology for Augmented Reality

⇨ Hardware: components for augmented reality are: a processor, display, sensors and input devices. Modern mobile computing devices like smartphones and tablet computers contain these elements, which often include a camera and micro electromechanical systems (MEMS) sensors such as an accelerometer, GPS, and solid-state compass, making them suitable AR platforms)

⇨ Software:A key measure of AR systems is how realistically they integrate augmentations with the real world. The software must derive real world coordinates, independent of camera, and camera images. That process is called image registration, and uses different methods of computer vision, mostly related to video tracking. Many computer vision methods of augmented reality are inherited from visual odometry. An augogram is a computer-generated image that is used to create AR. Augography is the science and software practice of making augograms for AR

⇨ Development:The implementation of augmented reality in consumer products requires considering the design of the applications and the related constraints of the technology platform. Since AR systems rely heavily on the immersion of the user and the interaction between the user and the system, design can facilitate the adoption of virtually.

Possible Application

Augmented reality has been explored for many applications, from gaming and entertainment to medicine, education and business. Application areas described below include archaeology, architecture, commerce and education.

Archaeology

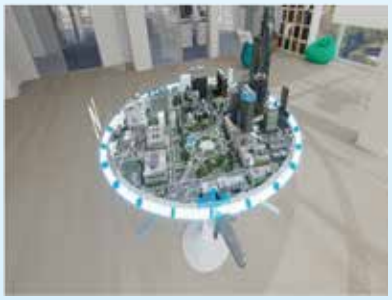
AR has been used to aid archaeological research. By augmenting archaeological features onto the modern landscape, AR allows archaeologists to formulate possible site configurations from extant structures. Computer generated models of ruins, buildings, landscapes or even ancient people have been recycled into early archaeological AR applications.

Architecture

AR can aid in visualizing building projects. Computer-generated images of a structure can be superimposed onto a real-life local view of a property before the physical building is constructed there

Urban design & planning

AR systems are being used as collaborative tools for design and planning in the built environment. For example, AR can be used to create augmented reality maps, buildings and data feeds projected onto tabletops for collaborative viewing by built environment professionals.



Education

In educational settings, AR has been used to complement a standard curriculum. Text, graphics, video, and audio may be superimposed into a student's real-time environment.

Industrial manufacturing

AR is used to substitute paper manuals with digital instructions which are overlaid on the manufacturing operator's field of view, reducing mental effort required to operate.[120] AR makes machine maintenance efficient because it gives operators direct access to a machine's maintenance history.

Fitness

AR hardware and software for use in fitness includes smart glasses made for biking and running, with performance analytics and map navigation projected onto the user's field of vision.

Industrial design

AR allows industrial designers to experience a product's design and operation before completion. Volkswagen has used AR for comparing calculated and actual crash test imagery. AR has been used to visualize and modify car body structure and engine layout. It has also been used to compare digital mock-ups with physical mock-ups to find discrepancies between them.

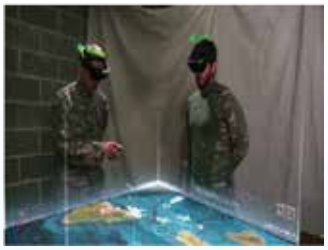
Healthcare planning, practice and education

One the first applications of augmented reality were in healthcare, particularly to support the planning, practice, and training of surgical procedures.

Flight training

Building on decades of perceptual-motor research in experimental psychology, researchers at the Aviation Research Laboratory of the University of Illinois at Urbana–Champaign used augmented reality in the form of a flight path in the sky to teach flight students how to land an airplane using a flight simulator. An adaptive augmented schedule in which students were shown the augmentation only when they departed from the flight path proved to be a more effective training intervention than a constant schedule.

Military



AR can serve as a networked communication system that renders useful battlefield data onto a soldier's goggles in real time. From the soldier's viewpoint, people and various objects can be marked with special indicators to warn of potential dangers. Virtual maps and 360° view camera imaging can also be rendered to aid a soldier's navigation and battlefield perspective

Navigation

AR can augment the effectiveness of navigation devices. Information can be displayed on an automobile's windshield indicating destination directions and meter, weather, terrain, road conditions and traffic information as well as alerts to potential hazards in their path. Since 2012, a Swiss-based company WayRay has been developing holographic AR navigation systems that use holographic optical elements for projecting all route-related information including directions, important notifications, and points of interest right into the drivers' line of sight and far ahead of the vehicle.

Tourism and sightseeing

Travelers may use AR to access real-time informational displays regarding a location, its features, and comments or content provided by previous visitors. Advanced AR applications include simulations of historical events, places, and objects rendered into the landscape.

Augmented Reality in Bangladesh aspects

1. Workers can be trained up by using AR in RMG and others sector.
2. Soldiers of Border guard Bangladesh can use AR for their training and
3. Bangladesh Police can use navigation to track criminals
4. Pilots from civil aviation and Bangladesh air force can use AR for their practice.
5. Student from different subject can use it for their practical session.

Internet of things (IoT)

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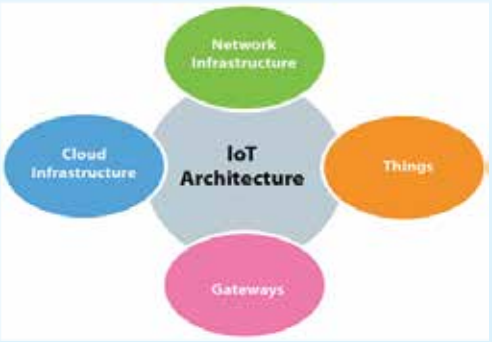
What is an Internet of Things (IoT)?

IoT is an advanced automation and analytics system which deals with artificial intelligence, sensor, networking, electronic, cloud messaging etc. to deliver complete systems for the product or services. The system created by IoT has greater transparency, control, and performance.

How does Internet of Thing (IoT) Work?

The working of IoT is different for different IoT echo system (architecture). However, the key concept of there working are similar. The entire working process of IoT starts with the device themselves, such as smartphones, digital watches, electronic appliances, which securely communicate with the IoT platform. The platforms collect and analyze the data from all multiple devices and platforms and transfer the most valuable data with applications to devices.



Features of IOT

The most important features of IoT on which it works are connectivity, analyzing, integrating, active engagement, and many more. Some of them are listed below:

Connectivity: Connectivity refers to establish a proper connection between all the things of IoT to IoT platform it may be server or cloud. After connecting the IoT devices, it needs a high-speed messaging between the devices and cloud to enable reliable, secure and bi-directional communication.

Analyzing: After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence. If we have a good insight into data gathered from all these things, then we call our system has a smart system.

Integrating: IoT integrating the various models to improve the user experience as well.

Artificial Intelligence: IoT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine itself order the coffee beans of your choice from the retailer.

Sensing: The sensor devices used in IoT technologies detect and measure any change in the environment and report on their status. IoT technology brings passive networks to active networks. Without sensors, there could not hold an effective or true IoT environment.

Active Engagement: IoT makes the connected technology, product, or services to active engagement between each other.

Endpoint Management: It is important to be the endpoint management of all the IoT system otherwise, it makes the complete failure of the system. For example, if a coffee machine itself order the coffee beans when it goes to end but what happens when it orders the beans from a retailer and we are not present at home for a few days, it leads to the failure of the IoT system. So, there must be a need for endpoint management.

Advantages and Disadvantages of (IoT):

Any technology available today has not reached to its 100 % capability. It always has a gap to go. So, we can say that Internet of Things has a significant technology in a world that can help other technologies to reach its accurate and complete 100 % capability as well.

Let's take a look over the major, advantages, and disadvantages of the Internet of Things.

Advantages of IoT

Internet of things facilitates the several advantages in day-to-day life in the business sector. Some of its benefits are given below:

- ⇨ Efficient resource utilization: If we know the functionality and the way that how each device work, we definitely increase the efficient resource utilization as well as monitor natural resources.
- ⇨ Minimize human effort: As the devices of IoT interact and communicate with each other and do lot of task for us, then they minimize the human effort.
- ⇨ Save time: As it reduces the human effort then it definitely saves out time. Time is the primary factor which can save through IoT platform.
- ⇨ Enhance Data Collection:
- ⇨ Improve security: Now, if we have a system that all these things are interconnected then we can make the system more secure and efficient.

Disadvantages of IoT

As the Internet of things facilitates a set of benefits, it also creates a significant set of challenges. Some of the IoT challenges are given below:

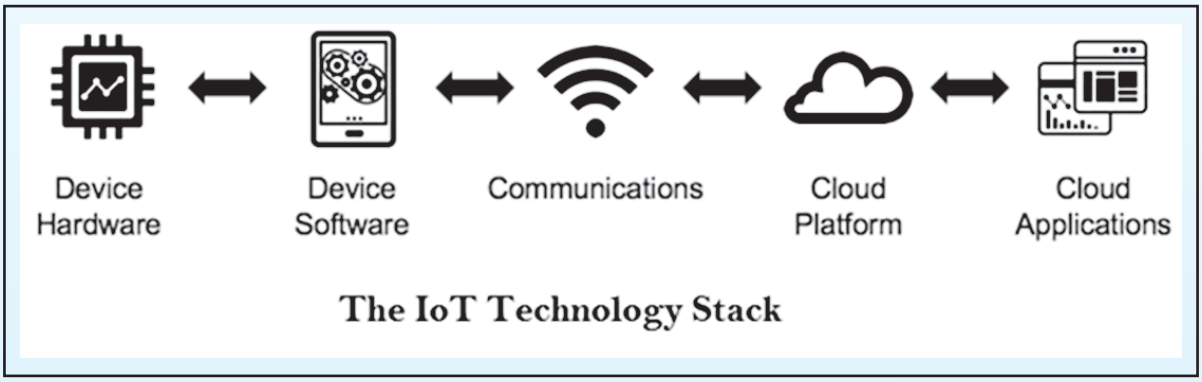
- ⇨ Security: As the IoT systems are interconnected and communicate over networks. The system offers little control despite any security measures, and it can be leading the various kinds of network attacks.
- ⇨ Privacy: Even without the active participation on the user, the IoT system provides substantial personal data in maximum detail.
- ⇨ Complexity: The designing, developing, and maintaining and enabling the large technology to IoT system is quite complicated.

IoT Decision Framework

The IoT decision framework provides a structured approach to create a powerful IoT product strategy. The IoT decision framework is all about the strategic decision making. The IoT Decision Framework helps us to understand the areas where we need to make decisions and ensures consistency across all of our strategic business decision, technical and more.

The IoT decision framework is much more important as the product or services communicates over networks goes through five different layers of complexity of technology.

1. Device Hardware
2. Device Software
3. Communications
4. Cloud Platform
5. Cloud Application



The IoT Technology Stack

4th Industrial Revolution
10 Technologies

Ministry of Labour and Employment