İSTANBUL
ESENYURT ÜNİVERSİTESİ
Our priority in education

Software Engineering

"Introduction"

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Exam Rules

1) Print Lecture notes are open. Know where the topics are, study the applications.
2) Write the calculation steps. 0 points when the number is written directly.
3) Computers and smart devices (phones, glasses, headphones, watches) cannot be on the table, above you or around you.
4) You cannot have any objects on the table or around you, including your clothing or bag, except water, print lecture notes, pencils and erasers.
5) There is a time limit. 20 questions 30 minutes
6) Sharing for lecture notes, pencils and erasers is prohibited.
7) Using a calculator is prohibited
8) Turning left, right, forward or backward is prohibited.
9) Ask your question to the teacher out loud from where you are sitting, it is forbidden to call the teacher to you.
10) The course notes for which you are responsible at exam will be given to you in advance.

Engineering

What is an engineer?

- Almost everything around us is there because of an engineer.
- An engineer designed it, then another engineer repurposed it!
- Engineers make working systems and machines.
- It is more interested in how it works than why it works.
- Uses scientific knowledge to achieve goals.
- An engineer takes risks based on incomplete information. Taking risks means paying the forfeit. She or He knows very well.

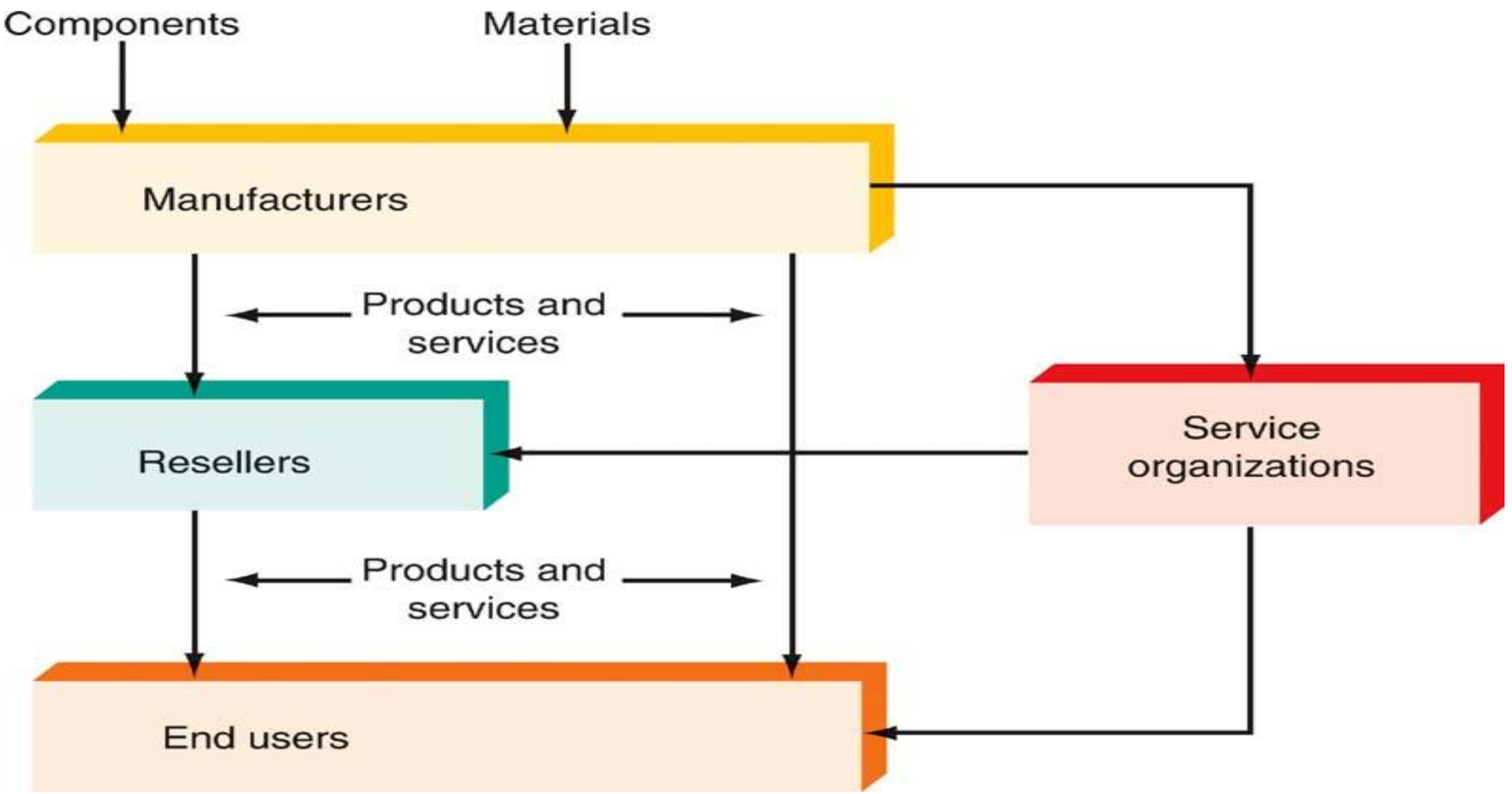
Who is an Engineer?

- Engineers are professionals who invent, design, analyze, build and test machines, complex systems, structures, tools and materials to fulfill functional goals and requirements.
- Engineering is the use of scientific principles, applied mathematics to solve problems.
- An engineer is one who experiences the practice of creating and maintaining services, systems, devices, machines, structures, processes and products to improve the quality of life; It is the one that does things more effectively and efficiently.
- Engineer is the one who searches for and finds the solution to the problem. He or she questions and investigates. She or he confronts and gives account.

Jobs in the Industry

- Engineers design equipment and systems.
- Technicians install, troubleshoot, repair, calibrate, and maintain equipment.
- Engineering Technicians assist in equipment design, testing, and assembly.
- Technical sales representatives determine customer needs and related specifications, write proposals and sell equipment.
- Technical writers generate technical documentation for equipment and systems.
- Trainers develop programs, generate training and presentation materials, and conduct classroom training.

Jobs and Careers in the Industry



“IESU”

Why IESU?

- IESU is located in the center of developing business centers and industry. (Hadımköy, Bahceşehir)
- Student-centered management approach prevails.
- Basic course details, course durations, and eligibility criteria are the main issues we attach importance to.
- Our library is at the service of our students with current scientific publications and books.
- Our basic professional laboratories are constantly updated.
- We have experience in mentoring and guiding students.

Vocational Courses for Computer Engineering

- Algorithm and Programming
- Scientific Research and Presentation Techniques
- Digital DesignComputer Programming
- Object-based programming
- Data Structures
- Computer Organization
- Signs and SystemsS
- Software engineering
- Operating systems
- Microprocessors
- Data Communication and Computer Networks
- Database Management Systems
- Web Technologies
- Data mining
- Formal Languages and Automation
- Embedded systems
- System Programming
- Machine Learning, Deep Learning
- Quantum Computing

When you finish the school as a software engineering.

- You will have knowledge of basic professional concepts.
- You will learn to ensure that software architecture meets security, performance, modularity, reliability and quality requirements.
- You will learn about the various standards (ISO and IEEE) and quality models used in the industry to measure and define the quality of software.
- When you graduate, you will have knowledge about errors, quality measurements, quality models and testing related to data analysis.
- You will learn to focus on techniques for planning and managing projects.
- You will learn about creating, adapting and transforming modeling languages. You will focus on creating DSL (Domain Specific Language).

Practice and Internship

- We have laboratory applications in our vocational courses.
- Emphasis is placed on computer applications and code software development activities.
- Internship and part-time job opportunities in industry, industrial automation and computer software companies

Differences
Between Computer and Software Engineering

Computer Engineering

- Computer Engineering refers to the science of both software and hardware inside a computer system. Explains mathematical formulas and technologies with theoretical and practical applications.
- CE is the branch of engineering that deals with the design, development, testing and maintenance of computer hardware and software systems.
- CE provides information about various areas such as processors, memories, data communication and database, etc.
- CE involves combining principles of electronic engineering and computer science to create new computer technologies and systems.
- Computer engineers work on a wide variety of projects, including the design of computer chips, the development of networking technologies, the creation of operating systems and software applications, and the design of computer systems for various industries.
- Some of the main focus areas of computer engineering are computer organization and architecture, computer networks, software engineering, embedded systems, and robotics.
- Computer engineers do not only work in the computer industry, they can work in all sectors and critical infrastructures, including research and development laboratories, production facilities and consulting firms.

Software Engineering

- People who educated, study and apply software engineering to create a product or system consisting of algorithms or mathematical models are called 'Software Engineers'.
- Software engineering describes how software is created and all the processes and steps involved in the creation of software.
- SE prepares students to become software engineers.
- Applies engineering and mathematical principles to create software.
- The software engineering process generally includes various stages such as collecting product-related data, designing, preparing algorithms, writing code, testing and maintenance.
- Software engineers are very familiar with various programming languages and platforms. Software engineers work and are responsible for writing clean, well-organized code that is easy to read and understand.
- They collaborate with other members of the development team, such as project managers, designers, and quality assurance engineers.

1. Differences
Between Computer and Software Engineering

- Software engineering and computer engineering are two different disciplines that focus on different aspects of computer systems.
- **Focus:** Software engineering focuses on the development of software applications, whereas computer engineering focuses on the design and development of computer hardware and systems.
- **Scope:** While software engineering deals with the entire software development process from design to maintenance, computer engineering focuses on the physical components and systems that make up computers.
- **Knowledge Areas:** Software engineering includes areas such as software design, programming, testing, project management and quality assurance. Computer engineering includes areas such as digital circuits, microprocessors, computer architecture and operating systems.
- **Applications:** Software engineering is used to develop a wide variety of software applications, such as desktop and mobile applications, web applications, and embedded systems. Computer engineering is used to design and develop computer hardware such as microprocessors, graphics cards, and motherboards.
- **Required Skills:** Software engineers need skills in programming languages, software design models and development frameworks, as well as project management and communication. Computer engineers require skills in digital circuits, computer architecture and hardware design.

2. Differences
Between Computer and Software Engineering

- Software engineering applies all the standards and principles of engineering to design, develop, maintain, test and evaluate computer software, also known as the life cycle of software development. Computer science is basically a combination of computer engineering, computer science, information system, information technology and software engineering.
- Software engineering involves only the study and implementation of software. Computer engineering involves the study and application of both software and hardware.
- Software engineers are programmers who study and apply the general behavior of algorithms and mathematical models in order to develop software. Computer science, on the other hand, examines the concepts of various subjects such as mathematics, electrical engineering, physics and management information system.
- Software engineering is a structured process that consists of checking, verifying and finding errors according to the needs of the software and then providing a solution to eliminate these errors. Computer engineering is not a structured process as everything has to be done in a specific process and requires proper study before implementation.
- Software engineering includes some areas of study such as software development, software testing and quality assurance, while computer engineering includes computer organization and architecture, data structures and database management, networking, artificial intelligence, etc. It includes work areas such as.

Computer Engineering

Computer Engineering (CE) -1

- In information technology and information systems management, CE approaches computing from a business perspective and focuses on the effective use of information and computer technologies.
- Computer engineering determines the procedures that must be observed in a software production process; As a result of negotiations with the order owner, CE determines the need, configures the design, writes the software, tests and maintains the software product.
- Computer science is related to many other disciplines that approach computing from different perspectives.
- Computer engineering focuses on the application of scientific theory and engineering principles in the development of new computing technologies.
- Computer engineering involves a rigorous approach based on the scientific method in analyzing and designing algorithms for problem solving.
- In particular, computer science creates hypotheses to validate the result of the algorithm, tests the hypotheses, and reviews the algorithm according to the results.

Computer Engineering -2

- A computer is a general-purpose device that is programmed to autonomously perform a set of comparative, arithmetic or logical operations. (ALU)
- He/she is the one who gains experience in the fields of computer science, information systems and software in order to meet the new requirements of the information age.
- Computer engineering is a popular major and offers good job opportunities after graduation.
- Job prospects for Computer Engineers are rapidly increasing both in Turkey and abroad due to their widespread use.
- Computer software engineers have bright career prospects.
- Computer engineering is a high paying branch. Code software engineers, in particular, are among the highest-paid people in the world.

Who is a Computer Engineer?

- Computer engineering involves a rigorous approach based on the scientific method, analyzing and designing algorithms for problem solving.
- A computer engineer is someone who has received basic training in both hardware and software and who designs, implements and manages information technology-controlled systems.
- Experiential knowledge is important in order to specialize in subjects in the fields of computer engineering.
- After graduating from computer engineering, you can specialize in hardware or software.

Computer Hardware Engineer (CHE)

- Designs computer hardware.
- CHE creates computer systems to be integrated with systems or machines.
- They test completed models of the computer hardware they design.
- Analyzes test results and updates expectations and changes in the design.

Computer Software Engineer

- Software engineers; They are an expert in programming, algorithms and data structures!
- Nowadays, They are claimed that anyone who integrates the components of an application, creates a beautiful mobile application or makes a website is a Software Engineer.
- Knowing a programming language or integration methodology does not mean that someone is a software engineer.
- You also don't have to be a Software Engineer to learn how to integrate components of an application or build a website. Software engineering is more than programming.
- As a software engineer, you are expected to have good foundations in applied mathematics and programming.
- Therefore, you will take programming-related courses such as Object-Oriented Design, database design, algorithm analysis, and data structures.

The Future of Software Engineering

«Those who hold the fire are definitely the ones who light up the dark night»

- Applications of artificial intelligence, learning machine algorithms and nanotechnologies in autonomous systems that will be used in space and brain travel in the near future.
- It is predicted that artificial intelligence, the internet of things (IoT: Battery, Computer, Sensors, Communication, Mobile, Software), and quantum computing will rapidly change our lives in the coming years.
- With nanotechnologies and sensing systems, computer technologies will undergo incredible changes.
- In a modern world that revolves around computers and technology, computer engineers play and will play a very important role today and in the future.

Software Engineering Subfields -1

- **Algorithms and Data Structures**
  - It is the development, analysis and application of algorithms for problem solving.
  - Programming is simply the application of algorithms
  - Algorithms are solving steps of a problem.
  - In order to write programs, the programmer must be familiar with algorithmic approaches and the data structures they will manipulate.
  - Data structures represent the way and order in which information is held in memory.
  - In addition, since the programs will be run by computers, the relationship between algorithms and hardware infrastructure should be well understood.

Software Engineering Subfields -2

- **Programming Languages**
  - They are coding tools that enable program development without knowing much about the internal structure of the computer.
  - Like natural languages, it has its own spelling rules and grammar.
  - Example: Basic, Fortran, Pascal, C, Java, vb.
  - AI softwares: Matlab, Python, C++, Java Script, Assembly

Software Engineering Subfields -3

- **Architecture and Organization of the computers**
  - **Computer architecture** is the features or details of the computer system that are visible to the user and required to be used.
    - Deals with methods of organizing hardware components into an efficient and reliable system
    - This concept answers the question of what is in the computer. Examples of this are memory capacity, processor clock frequency, etc. can be shown.
    - Computer designs are based on the von Neumann architecture (50s), but until today there have been many developments within this architecture to increase system performance and capacity.

  – Computer Organization includes the details that the system designer needs to know to design the computer system. This concept seeks an answer to the question of how to design a computer.

Software Engineering Subfields -4

- **Operating systems**
  - It is a software system that enables interaction between computer hardware and users and programs, offers some ready-made opportunities to the user and programs to be written later, and shares and manages system resources, whether hardware or software.
  - Example:DOS, Windows, Unix, Linux

Software Engineering Subfields -5

- **Intelligent Systems**
  - It is the development of software and hardware that can solve complex problems in a way that exhibits "intelligent" behavior.
- Software engineering
  - Developing and applying methodology for the design, implementation, testing and maintenance of software systems
- Human Computer Interaction
  - It is the design, implementation and testing of interfaces that will enable people to interact more effectively with computer technology.
- Bioinformatics
  - The application of computer methods and information structures to biological research.

Software Engineering Subfields -6

- Information and Data Management
  - Organization and efficient management of large amounts of data, development of pattern recognition and search methods in data
- Graphics, Imaging and Multimedia
  - Software or hardware systems that provide visual representation of physical or logical objects, such as images, videos, or three-dimensional holograms
- Computer Networks
  - Systems that enable computers and similar digital systems to communicate with each other under a certain protocol

IT Ethics -1

- **General Professional Obligations**
  - Engineers act in line with the highest moral values and assume responsibility in all their behavior, work and relationships related to their profession.
    - The engineer learns, follows and complies with the laws, rules and standards related to his profession.
    - The engineer shares his professional knowledge, skills and experiences without harming personal and corporate interests.
    - The engineer pays attention to the confidentiality and protection of private information regarding individuals and institutions.
    - The engineer complies with the obligations and contracts to which it is bound.
    - The engineer is realistic and unbiased in his predictions and determinations based on the data under his control.
    - The engineer informs the relevant parties about their interests within the scope of the work for which he is responsible, and does not act in favor of one of the parties in case of conflicts of interest, if any.
    - The engineer does not cooperate with people and institutions that he suspects are involved in corruption and dishonest activities.
    - The engineer rejects commission, share, bonus offers and any financial aid that may come from persons or organizations related to the work for which he/she is responsible, without the knowledge of the employer.
    - The engineer declares fully and accurately the professional qualifications that will be used as the basis for determining the salary.

IT Ethics -2

- **Product and Service Related Obligations**
  - The Engineer works to ensure that the product and production process reach the highest quality, efficiency and effectiveness.
    - The engineer ensures that the needs of users and those who will be affected by the system are clearly stated in the determination and design of system requirements.
    - The engineer is based on objectivity and acts constructively in the reviews, audits and tests carried out during the product development and production process.

Computer Engineering Disciplinary Areas

The relationship between electrical engineering and computer engineering -1

Electricity is very important in daily life.

- Electrical engineering involves developing and optimizing equipment, networks and devices that use or produce electric power.
- Computer engineering, a subset of electrical engineering, focuses on designing and creating hardware and software systems for different types of devices.
- Electrical engineering (EE) is the study and creation of systems, components and machines that use or produce electricity.
- The field of electrical engineering offers a broad array of research, design and development opportunities, particularly in vital, cutting-edge areas such as sustainability. For example, electrical engineers are improving electricity-fueled vehicles and their automotive parts, including engines, brakes and sensors, to advance the efficiency and safety of self-driving cars.
- In the renewable energy field, electrical engineers are researching and designing new wind turbine technology for cost-effective energy production and creating microgrids to make energy storage and distribution more efficient during natural disasters.

The relationship between electrical engineering and computer engineering -2

- Electrical engineering is vitally important in numerous industries, and therefore electrical engineers have their pick of focus areas in regards to job opportunities and skill development. These focus areas include:
  - Electronics
  - Computer engineering
  - Control systems
  - Power and energy engineering
  - Robotics
  - Radio frequency engineering
  - Signal processing
  - Telecommunication engineering

The relationship between electronic engineering and computer engineering

- Electronic engineers study the principles of electricity, current and microelectronics and how electricity interacts with hardware parts.
- Computer engineers study the function of computer hardware and how to design, build and use hardware with its software.
- Computer engineers often assist with the software engineering process as experts on the hardware they build. This helps the software and computer engineer align their goals and create synchronous software and hardware.
- While electronic engineers have computer skills, computer engineers have more advanced computer knowledge and skills that they develop throughout their careers. These skills help differentiate them from electronic engineers and other professionals like hardware engineers and computer scientists. Computer skills include the ability to diagnose problems, create computer programs and administer computer networks.
- Both electronic engineers and computer engineers have knowledge of electronics. Electronic engineers have a more complete understanding of how electricity moves through components and how to design electronic components. Computer engineers may study electronics in relation to computer electronics, such as microchips and computer memory, but may not use these skills daily.

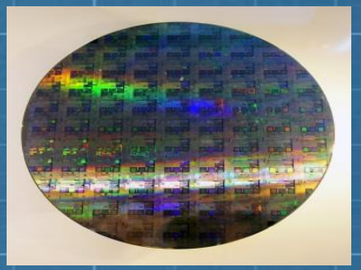
Communications Engineering

- Communications engineers design the devices and medium for people and machines which have computer systems all around the world to connect with each other, from the invention of the telephone in 1876 by Alexander Graham Bell to FM radio in 1890 by Edwin Armstrong. These engineers use complex theories to deliver all kinds of messages at high speeds around the world utilizing technologies such as fiber optics and 4G wireless data.

Micro-Electronics Engineering

- Micro and nano-electronic fabrication engineers design and build devices that are microns wide, working at such a small scale poses new challenges that aren't considered for larger builds. The circuits they build are usually on Silicon wafers layered with different components and geometries constructed through methods of growth, deposition, etching and more. Often the product is the processor chip, which small but powerful can run entire computer systems.

A micro-fabrication engineer working in a clean room. They have to extra caution not to bring dirt and other contaminants into the room to protect the nano-devices from possibly being ruined if a speck of dirt were to come in contact.



A silicon wafer is usually the base on which circuits are built on due to its ideal semiconductor properties

Control and Automation Engineering

- It is a branch of engineering that produces and applies information and technologies, ensuring that all electrical, electronic, mechanical and computer-based industrial production systems operate as intended and planned.
- Control and Automation Engineering Program provides training and research on "automatic control theory and applications, industrial automation, measurement and instrumentation, robotics, design and applications of computer-based industrial information systems".

Biomedical Engineering

- **Methods used for diagnosis:**
- x-ray
- Tomography and Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Positron Emission Methods (PET)
- Computerized Single Photon Emission Tomography(SPECT)
- Nuclear Medicine Methods
- Ultrasound
- Mammography
- Some methods using x rays

Mechatronics – a design process that includes

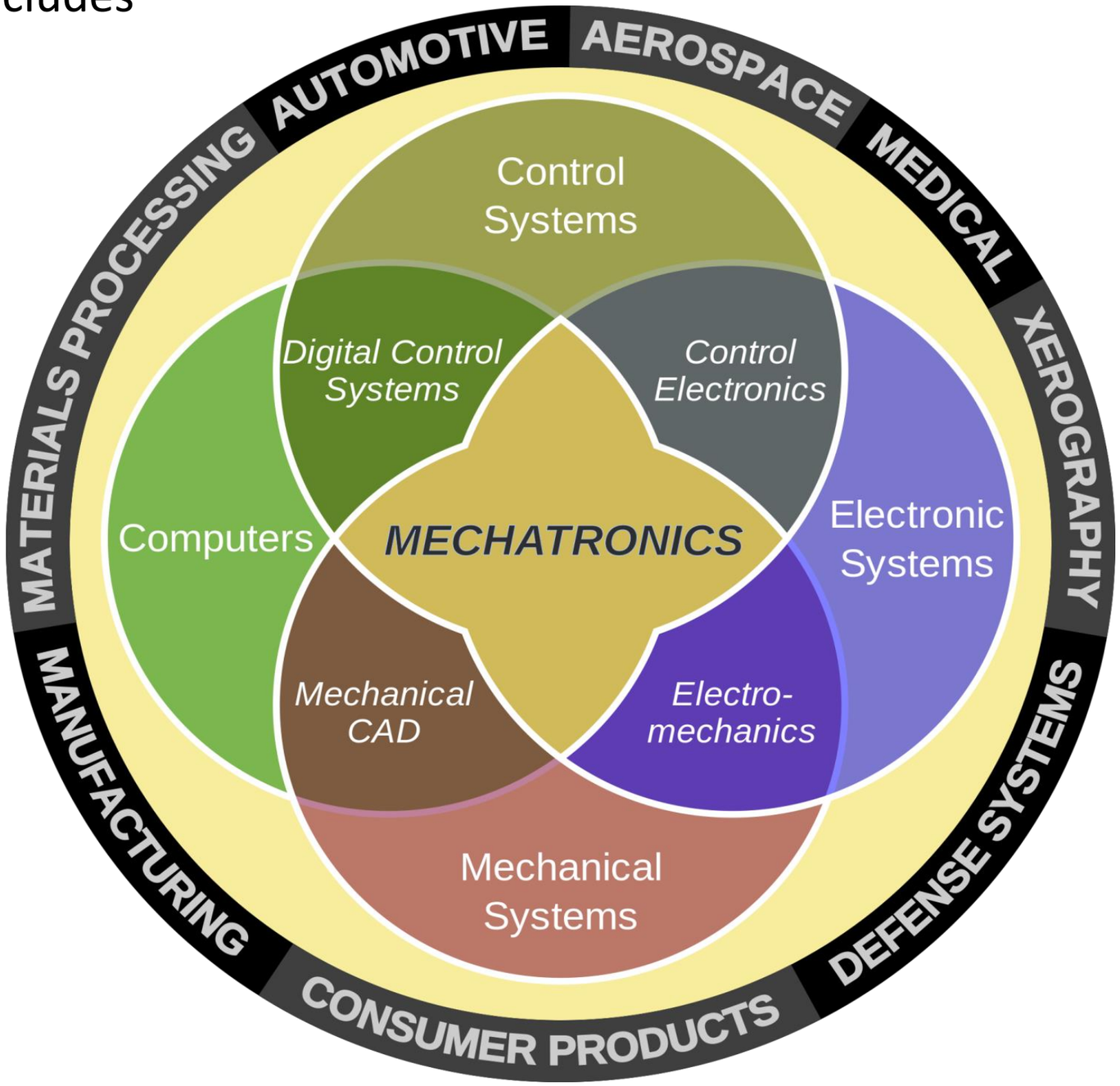
Mechanical engineering

Electrical engineering

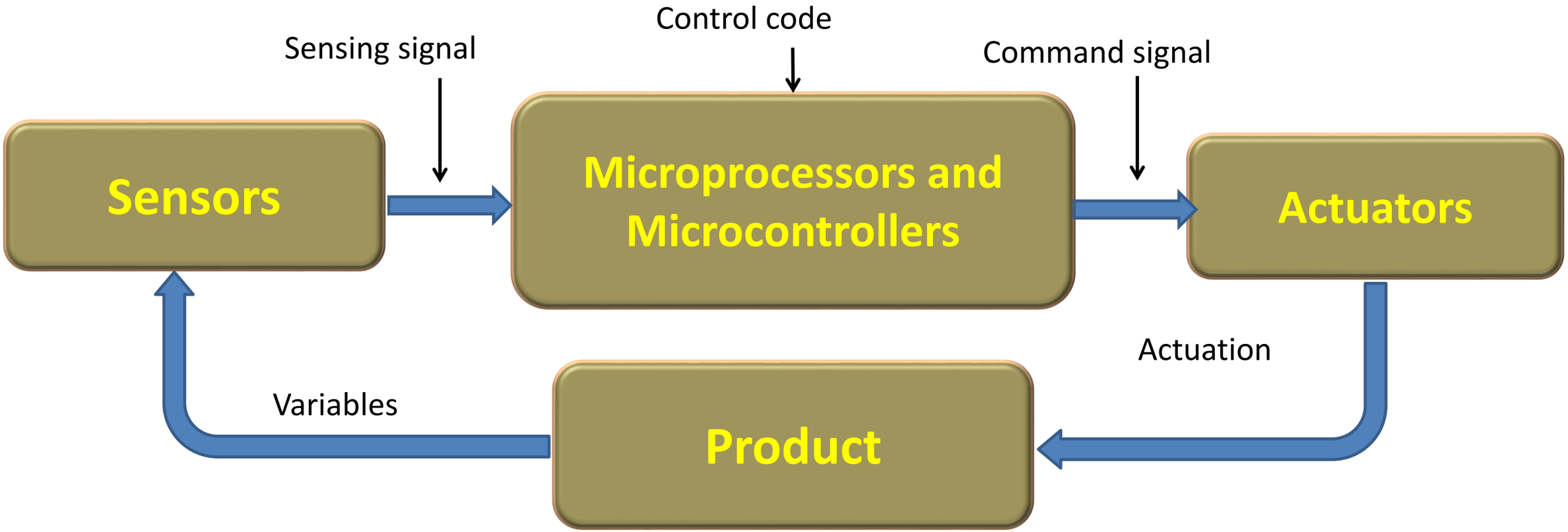
Control engineering

Computer engineering

Software Engineering



Mechatronics System



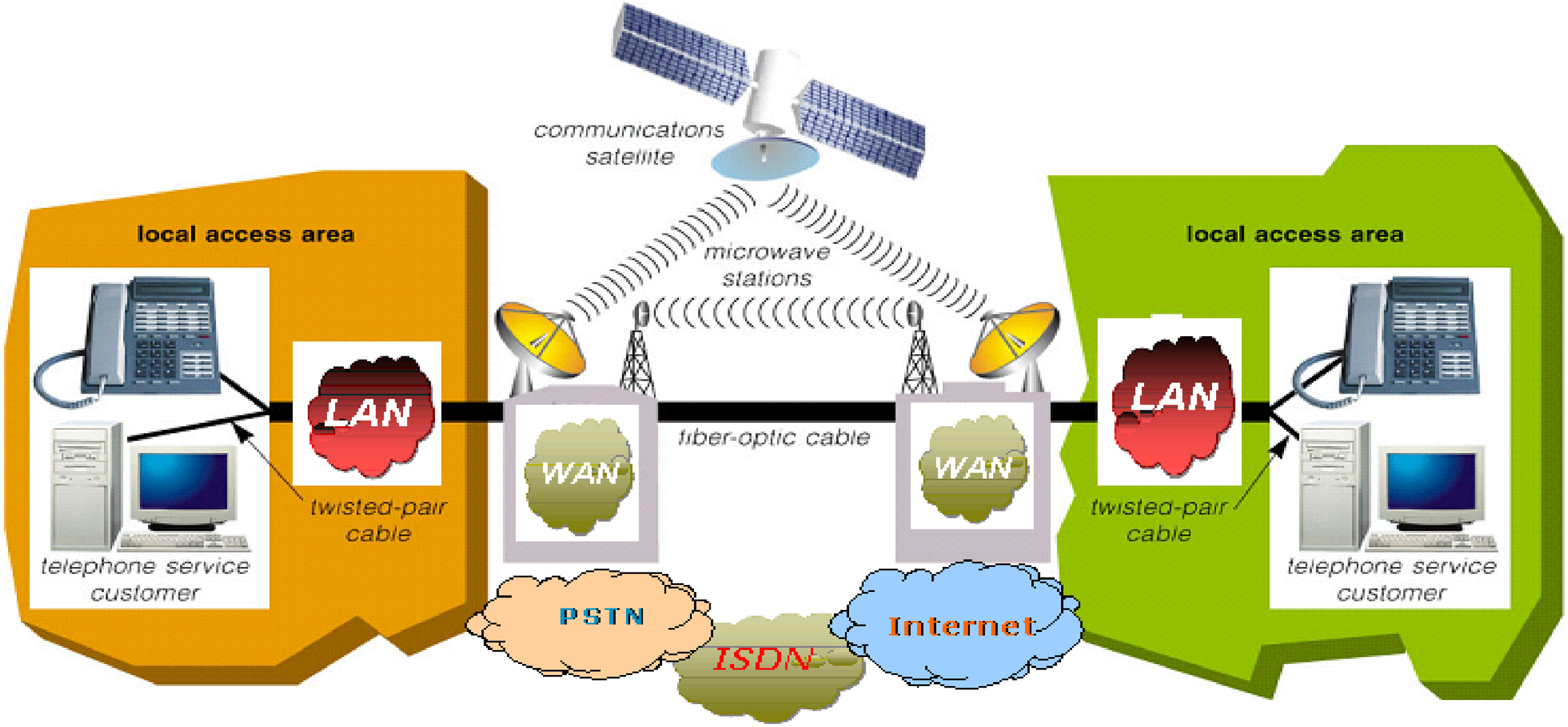
(Robot, Autonomous Guided vehicle, Numerical Controlled Machine,
Vehicle engines, Consumer products, Conveyor systems, Assembly systems, Cranes, Defense equipments, Air craft engines, etc)

“Communication Systems”

Communication Systems

- Communication: It is the transmission of information such as voice, image, video, data, telemetry from one point to another in high efficiency, high quality and securely.
- Communication system; It consists of the source, sender, communication medium and receiver circuits from which the information to be sent is produced.
- Communication medium: 2/4 wire, fiber cable, coaxial cable, air/space (satellite, radiolink, GSM, Infrared)

HABERLEŞME SİSTEMLERİ



The industry comes together at one point in communication.

Computer

- internet access
- Intranet access/ERP
- E-mail
- E-Education
- E-Commerce
- E-Business

Mass Media

- TV / Radio / Data distribution
- Radio / TV broadcasting, Press
- VHF and UHF radio
- Entertainment
- Multimedia information

Mobility

High Speed services

IP

Mobility

Individual services

Mobility

Broadband Services

Telecommunication

- Mobility
- Phone call over the internet
- Circuit switching to packet switching
- Broadband data

Telecommunications Media

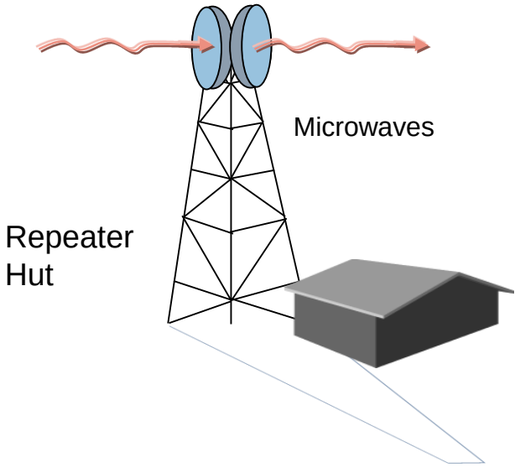
Conducted Media Radiated Media

Electrical Conductors

- Wires
- Coaxial
- Cable

Radio Frequency

- Broadcast
- Microwave
- Satellite
- Broadband Internet

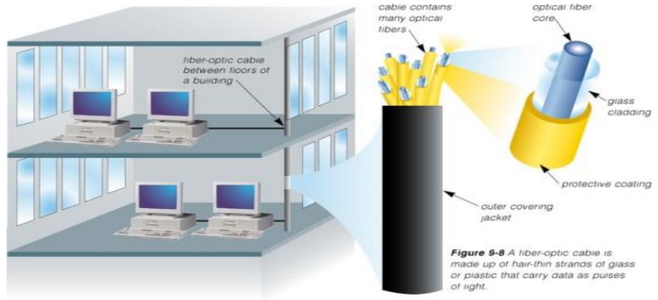


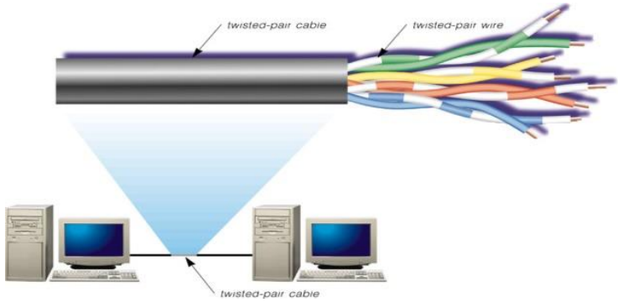
Light Conductors

- Fiber Optics

Light Frequency

- Infrared





“IT Based Technologies”

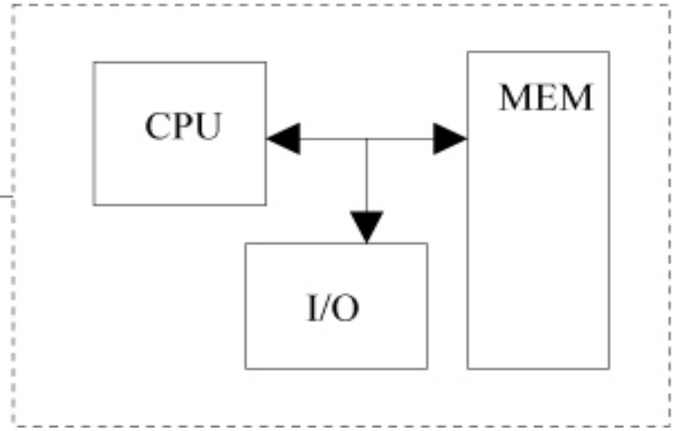
Transistor

- Semiconductor circuit element that controls the flow of electrons.
- Subatomic particles (Quantum Mechanics): Proton, Neutron, Electron, Phototron
- Electrical current or signal is created from the flow of electrons.
- The transistor memory element stores the bit (0/1) state on it. Performs Switching. Or it strengthens the signal.
- Transistor is the most used electronic circuit element in the world.
- The smallest basic electronic circuit element of a microprocessor is the transistor.
- As transistors turn on and off millions or even billions of times per second, the CPU's basic function cycles occur at a dizzying speed.

Basic Operations on the Computer

- Data Input: The computer receives data from outside to be processed within it.
- Data Storage: Data to be processed on the computer is stored in memories. (Register: Special Purpose Temporary Stores, Cache: Cache Memory, Ram: read or write memory (Volatile Memory), Rom: Read Only Memory (Permanent Memory,...)
- Data Processing: The computer processes data on the Registers in the Microprocessor (Arithmetic, Logic, Comparison, Transferring data between Registers or memories) according to the written commands, and reads or writes the data from the RAM memory. It carries out its work according to the codes on the ROM memory.
- Data Output: The computer produces the data it processes for external use.

Basic Components of a Computer System



Basic Components of a Computer System:

- CPU – Central Processing Unit (Mekezi İşlemci Birimi - Mikroişlemci)
- Main Memory: Stores data and programs to be written and read. (RAM:Data, ROM:Program)
- Input and output (I/O) unit – Peripherals
- System Bus: data, address and control. Communicate CPU with in memories and I/O's
- Clock – Timing: Synchronization functions

CPU Function Cycle:

- Processor Main Function Cycle(Fetching and execution cycles)
- Fetching: Writing and Reading data from or to Memory or I/O.
- Execution cycles : Arithmetic, Logic, Comparison processing.
- Address Decoding: Selects memory and memory cells to prevent the memory cells from overlapping. Which memory and which cell. In the same, only one memory and memory cell
- Clock and Timing Signals: It enables synchronous (simultaneous) processing of data.
- Pipelining – Pipelined command processing: These are functions in which a series of commands are arranged sequentially and executed simultaneously in parallel in order to increase efficiency.

Nanotechnology

- Atomic-scale technologies are developed to produce very small chips and logic gates. Transistors, which control electron flow, are the basic electronic circuit elements of computer systems.
- The diameter of an atom, including the electron cloud, is around 10^{-8} cm. The diameter of the atomic nucleus is about 10^{-13} cm. Its mass varies between 1.67×10^{-27} - 4.52×10^{-25} kg.
- Smaller devices can be produced with chips developed using nanotechnologies.
- In quantum computers, electrical conductors called nanowires can be just one atom thick, and a data bit is represented by the presence or absence of an electron.

IoT (Internet of Things)

- IoT, internet of things, are smart machines equipped with sensors that connect to each other, communicate with each other and produce information in a smart network structure using different protocols. With the development of mobile (mobile) networks and the internet, it has become easier for smart machines to communicate with people, and people have the opportunity to observe and control them from anywhere, anytime.
- In the near future, the amount of data that will emerge thanks to smart machines connected to each other will increase incredibly and analyzing and processing this big data will become difficult and complex.
- In addition, the confidentiality and security of data also emerge as an important issue.
- We will enter a period in which mutual interaction will enter into every object and different objects will move freely for common purposes. Meanwhile, how people will respond to this change physiologically and psychologically is also an important question.

Flying, Walking, Swimming and Integrating Nanorobots

- Scientists aim to use nanotechnology to create nanorobots that will serve as programmable antibodies.
- It will help protect against pathogenic bacteria and viruses that continue to mutate, and many drugs containing nanocomputers will neutralize microbes.
- It is predicted that nanorobots will be part of the future of human medicine.

Telemetry

- Telemetry is the remote monitoring or control of a system or monitor via cable or wireless. Today, when telemetry is mentioned, wireless communication is understood. The most commonly used ones are Radio modem devices, GSM GPRS and VSAT satellite systems.
- Systems that send commands to devices over wired, wireless networks or radio signals, transmit the measurement signals collected by the device from its physical environment, the status of the device as information to the center, and exchange information between the device and the center are called telemetry.

Transducer

- Devices that detect changes in the physical environment (heat, light, pressure, sound, etc.) are called "sensors", and devices that convert the information they perceive into electrical signals are called transducers. A transducer is a device that converts one form of energy into other forms of energy. Conversion can be electrical, magnetic, electromagnetic, chemical or thermal forms of energy. The transducer detects the parameter in one form of energy and converts it into another form of energy, most often as an electrical signal. For example, the pressure sensor detects the pressure and measures it, allowing the value to be displayed on the manometer or remote display device.

Transducer Examples:

- Antenna
- Electric motor
- Potentiometer
- accelerometer
- Fluorescent Lamp
- Bulb, LED, Photodiode, photo resistor, Photocell
- Speaker, headphone - converts electrical signals into sound.
- Microphone - converts sound into an electrical signal.
- Piezoelectric – converts solid-state crystals to electrical signals and vice versa

Actuator

- Actuators are devices that convert energy into movement. Systems such as an engine, hydraulics, pneumatics and pulleys that control or move a mechanism or system. It is powered by an energy source. This source is usually electric current, hydraulic fluid pressure, or pneumatic pressure and is converted into energy by some type of movement.
- Electric motors, pneumatic actuators, hydraulic pistons, relays, piezoelectric sensors, electroactive polymers are examples of actuators.
- The performance of actuators can be measured by speed, acceleration and force (alternatively angular velocity, angular acceleration and torque), as well as energy efficiency and mass, volume, operating conditions, strength, etc. is also taken into account.

MIT Biomechatronics - Hugh Herr

- At the age of 17, he became one of America's best climbers. However, while climbing a mountain, his legs were amputated because he was caught in a storm and froze. He currently owns immortal legs! “It is talents, not deficiencies, that count”, Andrew Carnegie .Hugh Herr is developing bionic limbs that mimic the function of natural limbs. Herr is responsible for groundbreaking advances in bionic limbs that provide greater mobility and new hope to people with physical disabilities.
- Herr's team developed the first autonomous exoskeleton to reduce the metabolic cost of human walking. Herr's Biomechatronics group developed gait-compatible knee prostheses and variable impedance for transfemoral amputees, for patients with foot drop, paralysis, cerebral palsy, and a gait pathology caused by multiple sclerosis. developed ankle-foot orthoses.He also designed his own bionic limbs, the world's first bionic lower leg, called the BiOM Ankle System. As published in the 2012 Proceedings of the Royal Society, the BiOM Ankle System has been clinically shown to be the first leg prosthesis to provide biomechanical and physiological normalization, allowing people with leg amputations to walk at normal speed and metabolic levels as their legs do.
- The biomechanics are different from ordinary dentures. Technological synthetic leathers are connected to the main body and understand what is intended to be done and act accordingly. In fact, they move so well that in trials with people without disabilities, it turns out that the support units work better than your biological limbs. Can you imagine? With the work done, biomechanical limbs that are sensitive enough to make a dancer dance again can be created.

Artificial Intelligence

Machines That Make Decisions by Learning -1

- Developing intelligence that learns from a mass of data in order to provide the ability of a computer-controlled system or device to perform its activities in a similar way to human intelligence may be possible with machine learning.
- It is the development of autonomous behavior independent of humans in a data stack with self-learning mathematical models and algorithms.
- Mathematical models and algorithms that develop data-based predictions and autonomous behavioral patterns are the basic software of computer systems in machine learning.

I ask:

- What happens in a person's mind when he makes a decision?
- What is vital for the decision maker?
- What is the key function in the human brain in decision making?

Machines That Make Decisions by Learning -2

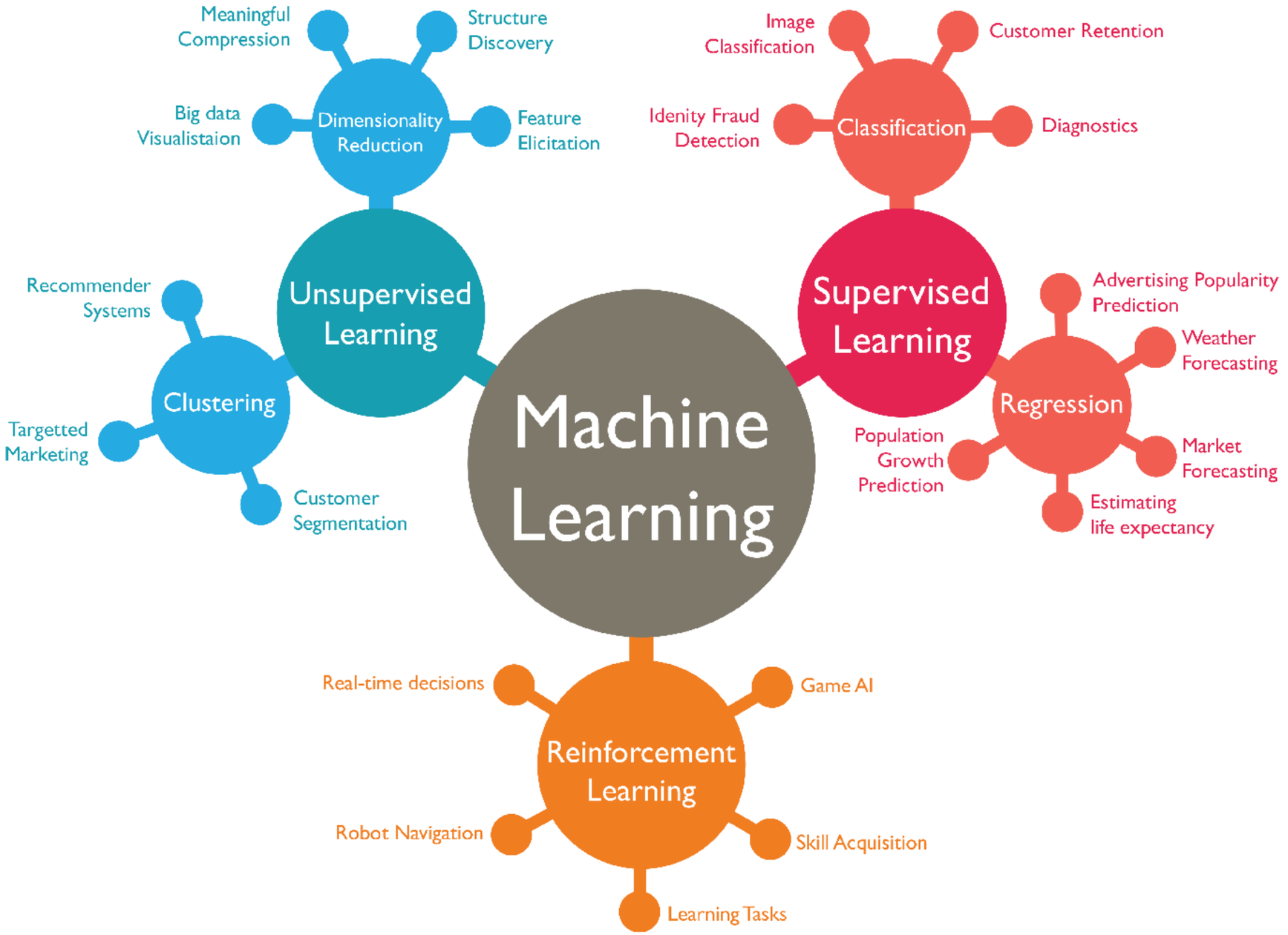
- Artificial intelligence is the general name of technologies that make any prediction or decision, whether using machine learning or not. Contrary to popular belief, artificial intelligence can be an algorithm that works without machine learning or deep learning algorithms. Until machine learning algorithms emerged, artificial intelligence studies were based on a structure that was described as "hard-coded", that is, all logical and mathematical operations were coded by the software developer. For example, the first chess player artificial intelligence algorithms were exactly like this. This type of artificial intelligence is called symbolic artificial intelligence.
- The area where artificial intelligence is most actively used is undoubtedly robotic technologies. The development of artificial intelligence has also directly affected the development of robotic technologies. Artificial intelligence, which can easily detect performance problems in robots, can fix the problems when necessary. Thus, robots can renew themselves.
- The feature that distinguishes machine learning from hard-coded symbolic artificial intelligence algorithms is that the algorithm learns entirely from data.
- The deep learning model discovers which parameters to give what weight according to the structure of the data.

Artificial Intelligence -1

- The term “Artificial Intelligence” was created in 1956 by John McCarthy of the Massachusetts Institute of Technology. It is a branch of computer science that aims to make computers behave like humans.
- Artificial Intelligence is the development of computer algorithms and mathematical models to play interactive games to develop machines that make decisions in real-life situations.
- Programming computers by developing algorithms and mathematical models to perceive and respond to sensory (Sense Organs) and physical stimuli, and designing systems that mimic human intelligence by developing structures similar to the types of physical connections between neurons (neural networks) in the human brain.
- Developing sensors, transducers, actuators and computer-controlled autonomous mobile machines, robotic arms and robotic organs.

Artificial Intelligence -2

- Artificial Intelligence is defined as the process where a machine tries to make decisions like a human brain. A collection of technologies known as artificial intelligence (AI) enables computers to carry out a range of complex tasks, such as the ability to see, hear, interpret, and translate spoken and written language, analyze data, generate suggestions, and more.
- The reason behind its hype around the world today is its act of working and thinking like a human being.
- Users' identities are determined from the traces they leave on the internet.
- Product or service purchasing habits, beliefs, political preferences and economic situations are determined.
- They are those areas/fields where the scope of error is/should not be left behind and with this there’s definitely a threat to human life as well. There have been many incidences where privacy breach has occurred.


Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

Artificial intelligence has already entered our lives!

- We think of human intelligence as something mysterious that is unique to human biological organisms.
- In fact, artificial intelligence has already entered our lives without us realizing it.
- Machines are actually starting to behave intelligently. Machines also started to learn and think logically like us. The steps of emotional thinking are in the research and testing phase.
- There is no definition of artificial intelligence that we can say this is artificial intelligence.
- Artificial intelligence is a set of applications developed by humans.
- Artificial intelligence can simply be defined as the ability to achieve complex goals. In this case, artificial intelligence is just irrational intelligence.
- Machines will be considered artificially intelligent when they see, hear, understand and learn the world in ways similar to us.

What can we do with artificial intelligence?

- We can hear and see better with artificial intelligence.
- It can give us brand new skills that we didn't have before.
- A doctor using artificial intelligence can develop smart drugs that have never been designed in a laboratory before. The smart concept here is that it goes to the location where the drug will be effective, adjusts the dose according to the situation there, starts the treatment and reports the result.
- Life expectancy can be extended in a healthier way.
- The real question here is, at the point we have reached in our history of consciousness, are we smart enough to make the choices we want?
- Today, scientists have begun to create the artificial intelligence road map of the future by developing artificial intelligence systems.
- How artificial intelligence will affect our tomorrow, our near and distant future, is entirely up to us. If we use artificial intelligence correctly, our lifestyles will be incredibly different and as humanity; From the moment we exist in this world to the point where we become conscious, the most valuable gems within us will begin to emerge.

Artificial intelligence application areas today

- Natural language processing: It is too difficult for computers to understand the question to be able to discuss it with humans. We understand the question very easily, but our memory capacity is not developed enough to give valid answers.
- Discussion with computer system
- Driverless Cars
- drone swarm
- Artificial intelligence robots working with humans
- Human-Like Conscious Robots
- Learning in childhood
- Learning during adolescence
- Helping visually impaired people see

Applications of Artificial Intelligence(AI)

- Artificial Intelligence in E-Commerce
- AI in Education Purpose
- Artificial Intelligence in Robotics
- GPS and Navigations
- Healthcare
- Automobiles
- Agriculture
- Human Resource
- Lifestyle
- Social media
- Gaming
- Astronomy
- Chatbots
- Surveillance
- Finance
- Data Security
- Travel and Transport
- Marketing
- Entertainment
- Military

Artificial Intelligence in Military

- Artificial Intelligence is also about to help defense and the military in the coming days. The government is planning to use artificial intelligence for various military operational support. Also, it will help in some automatic artilleries and weapons. Let’s take a closer look at AI applications in the Military.

- Decision Support: AI algorithms can analyze large amounts of data, including sensor inputs, intelligence reports, and historical information. These insights provide aid while taking an effective decision that includes stock management, resource allocation, and so on without actual human intervention.
- Cyberattack: AI plays a crucial role in detecting and responding to cyber threats in military networks. AI algorithms are capable enough to handle and manage vast datasets that can detect any abnormal activity before it actually occurs.
- Training: AI uses algorithms to train their staff in different situations that can make it more or less realistic. This can help them in making the right decision at the moment and strategies their plan effectively.

Privacy

- Artificial Intelligence applications will hear, see and analyze us, challenging the perception of privacy.
- One of the most important reasons for privacy is that it has tremendous potential for surveillance.
- Facial recognition can detect the biological traces we leave in our environment and identify you.
- Beyond that, you will be able to hear what you have to say and understand your purpose.
- Cameras instead of eyes, microphones instead of ears, and artificial intelligence applications are being developed to understand what they see.
- What is the perception limit of computers?
- Artificial intelligence can find its way in three-dimensional spaces with computer vision. It allows driverless cars to see their surroundings. A person's facial expression can be understood. With facial analysis, people walking on the streets can be identified.
- He can take a photo of you anytime, anywhere. You may suddenly be exposed, sometimes in legal processes and sometimes in the virtual environment.
- The aim is to identify you within seconds. Anything you do wrong is sent to your home via mail. Your social circle is determined and sent to your friends.

The line between humans and machines

- Even if we don't want to, technology will continue to rain on us.
- The most ironic part is that we introduce these technologies into our homes completely voluntarily.
- You leave home and come to school. Your personality, political thoughts, beliefs, and even whether you can be provoked can be determined by an artificial intelligence application.
- Is it right that your belief, political opinion or whether you are a member of a social class can be determined based on your facial expressions? Do you know that studies on this subject have found 75% accuracy?
- Can artificial intelligence tell if someone is guilty just by looking at their face? Studies on this subject show that the probability of identifying thieves reaches 90%.
- Artificial intelligence applications that predict personality traits based solely on facial images have begun to serve. There is no database. An analysis is made by looking at your face based on past experiences. People are detected before they commit a crime, imagine if they were arrested before they even committed a crime.
- Artificial intelligence should definitely improve people's problem-solving skills and make them more prosperous and healthier.
- Artificial intelligence must contribute to the awareness process of humanity.
- Can a drug that will be beneficial for another disease be determined from the millions of drug literature produced?
- Artificial intelligence is still at the very beginning of its medical applications.
- Artificial intelligence can determine which drugs are more suitable for you and which diseases you are more prone to.

Artificial general intelligence

- The ultimate goal is to create something called artificial general intelligence (AGI). Thus, an adaptable mental being will emerge.
- You may find a machine that is at least as smart as humans or even smarter than them scary. They can suppress us somehow, take control away from us.
- The computer can find ways to write its own software.
- Can super artificial intelligence be made by humans? Or will machines do it?
- There will certainly be times when machines will teach other machines something. Millions of driverless vehicles will teach each other things without people knowing.
- We should not create a situation where human-level artificial intelligence is developed, or where robots are designed so that their will cannot be interfered with.
- Calculations show that it would be impossible to control a super-intelligent AI.
- To control Artificial Intelligence (AI) far beyond human understanding, we need to analyze the simulation created by the AI.
- However, if we cannot grasp the power of future artificial intelligence and understand the scenarios that artificial intelligence can reveal, it will be impossible for us to create such a simulation to have control over it.

Instant decisions made when human life is in danger

- What happens when artificial intelligence gets behind the wheel?
- Artificial intelligence once belonged to the world of science fiction, but now it seems to appear everywhere at any time.
- Ford's pizza robot delivers food to your door.
- The biggest discovery expected with artificial intelligence has been driverless cars.
- Artificial intelligence applications used in driverless car technologies will have incredible impacts on life.
- News about Google's test vehicles and Tesla's automatic cars began to be heard frequently.
- Driving is very difficult.
- In ordinary traffic, where everything goes well, there is no problem. It exceeds the capacity of artificial intelligence in conditions that even humans have difficulty with in crowded, dark and rainy weather.
- Tens of thousands of people die in traffic accidents every year.
- Driverless cars were mostly used on test tracks.

Reflections of Artificial Intelligence on the future

- If an anthill is within our project, does it make us bad to destroy that anthill? Our goals are not the same as those of ants. This situation has bad consequences for the ants. We should not put people in the situation of ants.
- When we were children, our parents were smarter than us. There was nothing to be afraid of. Because their goals and their children's goals are the same.
- Artificial intelligence will be made to create a better society.
- It will provide the opportunity to create a better, inspiring future.
- Artificial intelligence is a tool; It is a tool that will help a doctor or an engineer to become better at their job.
- It is a tool that will accelerate the scientist's discovery process.
- Artificial intelligence should not be put into frameworks that do everything for us.
- It should not be seen as a power that dominates us and takes away all control.
- Technology is a tool that allows us to achieve our goals.
- We decide who the technology will serve.

Job and Carees

Jobs and Careers in the Industry

- The electronics industry is roughly divided into four major specializations:
  1. Communications (largest in terms of people employed and the dollar value of equipment purchased)
  2. Computers (second largest).
  3. Industrial controls.
  4. Instrumentation.

- Future
  1. Defense Industry
  2. Medicine
  3. Automation – Computer – Sensor
  4. Signal Processing – Data Analysis
  5. Security

Research Areas

- Automatic control
- Communication systems
- Computational science and technology
- Electric power and energy systems
- electromagnetic engineering
- Electronic Engineering
- Fusion plasma physics
- Information science and engineering

Fields of study

Science: Applied mathematics, statistics, probability and analysis
Artificial intelligence application areas
Quantum Computing
Control: Design of dynamic systems and controllers for the systems
Electronics/Microelectronics: Design of integrated circuits, microprocessors, etc.
Signal Processing: Analysis of signals
Telecommunications: Design of transmission systems (voice, data)
Computer: Design and development of a computer systems
Instrumentation: Design of sensors and data acquisition equipments
Medical science
Viewing space and mines
Swarm of Robots and Drones
Network technologies and Internet
Mobile applications
Game

Increasing Job Demands

- Data mining: Used by e-commerce websites such as Amazon to understand consumer behavior; It is also used by banks to calculate the probability of repayment of debt.
- High-throughput system design: Used not only by search engines such as Google, but also in industry and finance.
- Geographic information systems
- Performance analysis
- Embedded systems programming: Siemens, Erickson and other embedded device companies and manufacturers, as well as electronics for automobiles.
- Firmware interface in mobile systems: Motorola, Samsung, Apple.
- Operating systems for mobile devices: Nokia and Microsoft also do a lot of work at Google and Apple
- Developing mathematical models in machine learning
- Energy grids management systems

Today's Computer Engineering

1- Quantum Computer and Quantum Computing

2- Artificial Intelligence, Data Science, Database management, Data preparation

3- Artificial Intelligence, Machine learning Algorithms

4- Automation / Autonomous: Machines with computer systems (Computer Organization, Microprocessor, Assembly)

5- Algorithm and Mathematical models

6- Software Languages: Python, Java Script, C++, Matlab, Assembly

Technological developments of the future

- Artificial Intelligence Applications, ML, DL
- Robotic business processes,
- M2M, Brain to Machine
- Virtual reality: gaming, brain to machine, mental health treatment, personal socialization in a virtual environment (relief from loneliness)
- Digital soldiers, Biology/organism/organ/animal to machine: Monitoring, communication, guidance, remote organized game or business process management, operation
- Drone – unmanned vehicles: Mines, Search and Rescue, Mine plunder in space
- Remote sensing
- Mathematical modelling, estimation and probability
- Health: Diagnosis, treatment, diagnosis, operation

Job opportunities for Computer and Software Engineer -1

- Planning/Analysis Phase,
  - Business analyst
    - This is a position that works to understand customers' needs.
  - System Analyst
    - In general, a system analyst is a person who designs an entire IT system and proposes solutions according to need.
- Design Phase,
  - Software Design Specialist
    - They are the person who plan the entire software structure, including the infrastructure components of the software.
  - Software Modeling Expert
    - They describe the functioning of the software using the modeling and diagramming language called UML.

Job opportunities for Computer and Software Engineer -2

- Development Phase,
  - Software Architect / Software Consultant
    - They select the technologies to be used in the project, make recommendations on the project methodology and processes, create and maintain the general design and structure of the application, ensure the correct definition of the project, and deal with documenting the design and determining coding standards.
  - Team Leader / Project Manager
    - Project Leader/Manager is the manager who keeps the software team together and provides the necessary motivation to comply with timelines.

Job opportunities for Computer and Software Engineer -3

- Testing/Quality Assurance Phase means the work that checks that the software project complies with the standards and meets the needs.
  - Software Quality Specialist
    - They are the person who checks whether the needs and the developed solution are determined correctly and whether the software meets certain standards.
  - Test Specialist/Test Engineer
    - They carry out the work of detecting software errors and managing the process regarding the causes and consequences of errors.
  - Test Manager
    - They decide whether the software has passed the test and whether they are ready for acceptance.

Job opportunities for Computer and Software Engineer -4

- Data and database management
  - Data Manager
  - Data Analyst
  - Data Modeling Expert
  - Data Miner
  - Database Administrator
  - Database Architect
- IT security
  - Information Security Specialist / Manager
  - Network and Internet Security Specialist
  - Security Advisor

Job opportunities for Computer and Software Engineer -5

- Network management
  - Network Analyst
  - Network Administrator / System Administrator
  - Network Engineer
  - Network Support Specialist
- Web/Internet
  - Content Manager
  - Web Designer
  - Web Developer
- Multimedia
  - 2D/3D Graphics Expert
  - Multimedia/Graphic Designer
  - Educational Designer

Job opportunities for Computer and Software Engineer -6

- Instructor/Academic Career
- Documentation Specialist/Technical Writer
- E-commerce specialist
- CIO(Chief Information Officer) □ is a senior management position. CIOs determine the IT vision of companies, manage technology budgets, make strategic technology investment decisions and measure the return on investments.

Conclusion

- Humans are the only living species that can transmit and expand their knowledge base from generation to generation.
- Knowledge accumulated over centuries; A person who does not think, does not want to think, or is prohibited from thinking will quickly disappear from his life. Every living species follows a certain course of action required by its nature in order to survive.
- The difference between man and others is related to the mind that is essential to sustain his life: everything that man needs has to be discovered by his mind and produced by his labor.
- Humanity will owe its eternal survival to the consciousness it will develop freely.

You made your decision for tomorrow yesterday. The moment you decided, you initiated the changes. This change will change not only you, but your family, your environment, your country and the world beyond.

It is normal that curricula and laboratories vary from university to university, but wherever you are, you have to focus on what I have told you to become a quality computer engineer.

Thank you.

Istanbul Esenyurt University
Dr. Lecturer Cahit Karakuş