

Developing Responsibilities of Computer Engineers in the Era of AI and Automation

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Abstract

Through the design, development, and optimization of computer systems and software, computer engineers play a pivotal role in influencing the constantly changing technological landscape. They have experience in a wide range of fields, such as network architecture, software development, embedded systems, hardware design, and cybersecurity. These experts make substantial contributions to developments in a variety of fields, including artificial intelligence, telecommunications, healthcare, and finance. This article explores the various roles that computer engineers play, emphasizing how they contribute to innovation, problem-solving, and system integration. It also looks at the fundamental abilities needed to succeed in this fast-paced industry, like mastery of programming, critical thinking, and technological flexibility. Computer engineering is constantly changing due to the quick developments in artificial intelligence, machine learning, and the Internet of Things (IoT), which necessitate ongoing education and specialization. The article also looks at the trends that will shape the field in the future, highlighting the increasing significance of automation, cloud computing, and quantum computing. Computer engineers continue to play a crucial role in creating scalable, secure, and effective solutions as technology grows more complex. In the end, this article emphasizes how important computer engineers are to advancing technology and solving difficult problems in the digital age.

Keywords: Artificial Intelligence, IoT, Machine learning, Deep learning, Computer Science.

Introduction

For the benefit of people, computer engineers create, develop, and use hardware and software. These experts have been crucial in converting the previous industrial society into the information society of today. They have given computers and communication systems vitality, enabling digital technologies to blend in with their environment. The Internet was created and established by computer engineers, fostering globalization and enabling pioneer talent to travel. Computers have been essential in deciphering large amounts of data, which has resulted in the diagnosis of diseases and economic forecasts (Meade et al., 2019). Computers operate automobiles and aircraft, diagnose patients, and provide entertainment in homes. Computers are used to control births, and synthetic intelligence is used to manufacture various technical products [1-6].

Computer equipment can be shared over a network and is a great asset to all forms of education. Because of computers' increased processing power, workplaces have changed, and as a result, manufacturing, accounting, and warehouse management tasks have become more automated. But competition has grown quickly, and humans are better at many tasks. For

aspiring professionals, education is just the beginning; learning is a lifetime endeavor. Consequently, computer systems have become much more complex. The communication device is already the most complex system, and rebel equipment is more intricate than the household tools found in cars [7-10].

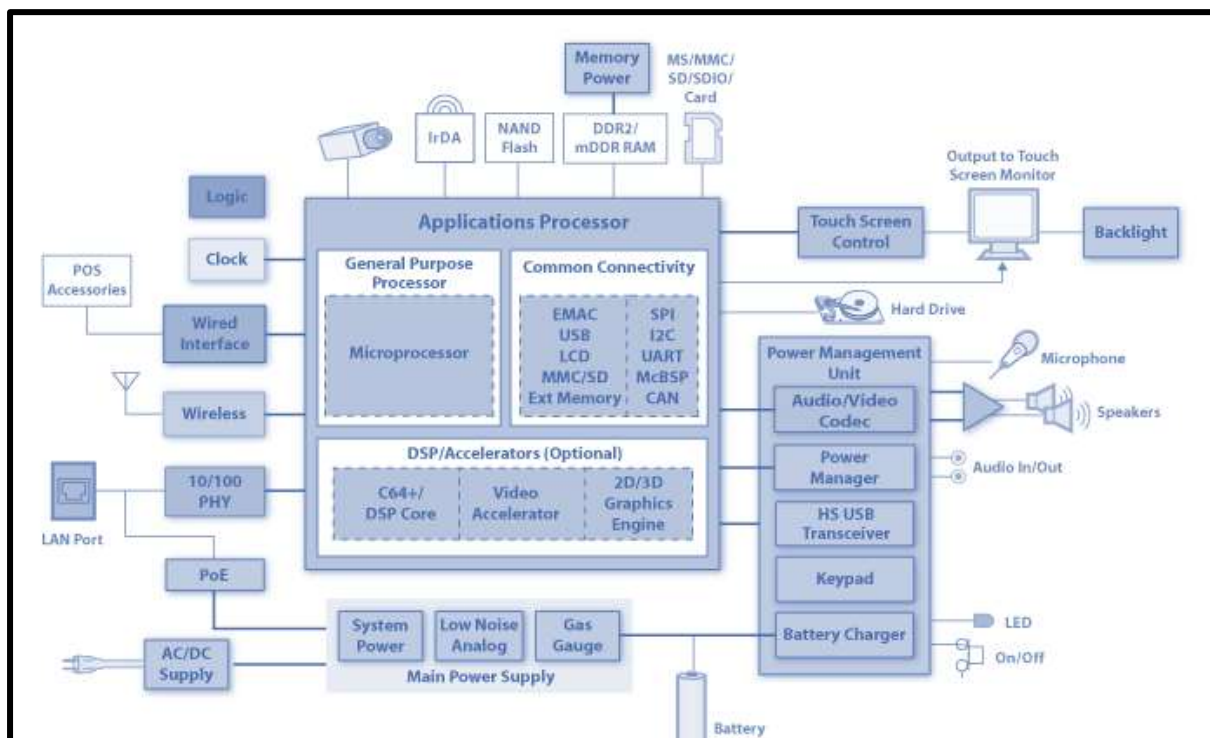


Fig.1 Overall block diagram

The Internet of Things will force all equipment to engage in communication for the upcoming generation. Computers may collaborate with people and share tasks to some extent for the benefit of humans. Because each digital transaction requires processing power, the amount of electricity required to operate digital technologies has been doubling every four years. Because supercomputers are not fast enough, weather forecasts are no longer accurate. The efficient use of electricity in information technology should be the main focus of policymaking. Could the gap problem be resolved by using memristors or biochips? Recycling is a problem, though, and both materials are challenging. The study of computer engineering integrates many different fields, making it a very broad profession. Thus, simplified models will be used in this work to address the complexity. There will be a chance to use ideas to contribute to the discussion, and additional developments of the topics covered are encouraged [11-13].

Literature Review

The literature on computer engineers emphasizes the importance of technology, ethics, and education in this rapidly evolving discipline. The impact of computers and software on modern life requires professionals to navigate a complex landscape of ethical responsibilities. Cognitive engineering, a multidisciplinary approach, emphasizes the need for continuous adaptation to technological advancements. De O. Melo & C. de Sousa highlight the educational dimensions of software engineering, particularly for millennial engineers, and the need for ethical dilemmas and systemic thinking. The profession has expanded beyond traditional boundaries, emphasizing the strategic implications of technology decisions and the

integration of automation in software development processes. Non-technical skills, such as communication and teamwork, are essential for software engineering education. Zhang et al. (2021) explore the integration of artificial intelligence within civil engineering, highlighting the potential for AI to enhance decision-making processes while addressing unique challenges [14-16].

Wolf (2022) provides an overview of computer engineering as a discipline focused on designing systems that meet societal needs, emphasizing the dual role of computer engineers as both creators of technological solutions and responders to societal demands. Washizaki (2022) addresses the critical issue of gender diversity in software engineering within the Asian context. David R. Wright's article, "Motivation, Design, and Ubiquity: A Discussion of Research Ethics and Computer Science," argues that ethical conduct in computing is essential, especially as the field evolves rapidly and often outpaces the establishment of ethical guidelines. Ethical review processes, especially for projects involving human subjects, are crucial for ensuring responsible technological advancements. The article "A Survey of Brain Inspired Technologies for Engineering" by Son and Mishra (2016) highlights the importance of understanding the multidisciplinary approaches in cognitive engineering, emphasizing the need for regular reviews within the research community to stay abreast of emerging trends and technologies. The authors also argue for the development of cognitive machines through the integration of brain-inspired technologies, highlighting the role of computer engineers in enhancing machine intelligence. The article "Reflections on Cyberethics Education for Millennial Software Engineers" by Claudia de O. Melo and Thiago C. de Sousa (de O. Melo & C. de Sousa, 2017) examines the evolving role of software engineers in addressing complex societal challenges. They argue that software engineers must adopt a systemic and adaptive approach to problem-solving, particularly in the context of the intricate and unpredictable nature of contemporary challenges. The authors highlight the need for innovation in how ethical considerations are integrated into education, as technological advancements accelerate and the ethical implications of software development become increasingly pronounced. They suggest that software engineers must engage with these ethical issues proactively, rather than reactively, to foster a generation of engineers who are not only skilled in technology but also aware of the broader societal implications of their work [17].

The article "The changing role of the software engineer" by Meade et al. (2019) provides a comprehensive exploration of the evolving landscape of software engineering, highlighting the multifaceted responsibilities that modern software engineers must navigate. Automation in software development facilitates rapid software feature delivery, continuous integration, and agile development methodologies, but they also pose challenges for teams relying on detailed documentation for knowledge transfer and project continuity. The article "Software Engineering Education Beyond the Technical: A Systematic Literature Review" by Groeneveld, Vennekens, and Aerts highlights the evolving educational landscape for software engineers, highlighting a critical gap between technical training provided by higher education institutions and industry expectations. The authors emphasize the importance of noncognitive skills, such as self-reflection, conflict resolution, communication, and teamwork, which are essential for success in the field. They also highlight the importance of practical experiences, such as internships and capstone projects, in facilitating the development of these soft skills.

The article "Toward Integrated Human-Machine Intelligence for Civil Engineering: An Interdisciplinary Perspective" by Cheng Zhang et al. discusses the integration of artificial intelligence (AI) within the civil engineering sector, specifically focusing on the concept of

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Integrated Human-Machine Intelligence (IHMI). The authors highlight four significant knowledge gaps that must be addressed to fully leverage IHMI in civil engineering, including the types of tasks AI can assist with, the need for a clear definition of the human-AI interface, barriers to collecting detailed behavioral data, and uncertain impacts of IHMI on the Architecture, Engineering, and Construction (AEC) industry. The article also discusses the dual role of computer engineering in both the design of digital computers and the broader societal implications of these technologies. It emphasizes the importance of both theoretical knowledge and practical skills in the education of computer engineers, suggesting that a robust curriculum must integrate these elements to prepare students for the complexities of the field [18].

In conclusion, the articles highlight the need for a more integrated approach to education, fostering not only technical skills but also critical thinking and ethical reasoning. The article "Systematic Literature Review of Gender and Software Engineering in Asia" by Hironori Washizaki (2022) explores the intersection of gender dynamics and software engineering in Asia. It highlights the importance of diversity and inclusion in the field, highlighting the roles, challenges, and opportunities faced by individuals of different genders. The review highlights the need to understand the unique societal and cultural contexts that shape gender experiences in software engineering. The article highlights the need for tailoring educational and professional development initiatives to address the unique challenges faced by different genders in software engineering. This will foster a more inclusive environment that encourages participation from diverse groups, ultimately leading to more innovative and effective software solutions. The literature on computer engineers highlights the multifaceted responsibilities these professionals hold in modern society. It emphasizes the ethical implications of computer engineering, the need for a robust ethical framework, the importance of automation and agile methodologies, and the integration of soft skills into engineering education. The literature also highlights the dual role of computer engineers as creators of technological solutions and responders to societal demands. It emphasizes the need for educational frameworks to adapt, ensuring future engineers are equipped with the necessary skills and ethical grounding to navigate the complexities of modern technology.

Computer engineering has evolved from simple mechanical devices for calculations to large-scale computers designed for general engineering calculations. The first large-scale computer was the General Electric Automatic Computer, which was the first large-scale computer intended for general engineering calculations. Computer engineering introduces new knowledge, including hardware principles of computer systems and software principles, such as algorithms and programming paradigms. The appeal of computer engineering lies in high design pay-off achieved through understanding, efficiency in analyzing systems, and understanding the mathematics and logic that underpin results obtained from simulating a system [19].

The interdependence of hardware and software in system design makes it difficult to consider the one without the other. Modelling and simulation are crucial elements of the design and testing of most systems. At the core of computer engineering is the digital system, a conceptual model for thinking about such systems, and basic design flow logic. Advanced topics, such as behavioral models and system design, build up from this base. A thorough knowledge of at least seven conceptual topics will provide a valuable foundation for further blue-sky research. The science is all about reducing the number of unknowns, unwanted byproducts, and by-catch, and either treating the rest as constants or modeling them in some other way. This section focuses on hardware design and development in computer engineering, focusing on the role of computer engineers in creating reliable, efficient, and

cost-effective hardware. Hardware design involves creating components such as processors, memory units, and peripheral devices, which are connected separately and tested separately. Software engineering principles are crucial for computer engineers to develop effective software solutions. As the world becomes increasingly digitized, the need for stable and effective software solutions has become more prominent. Computer engineers need to understand software development life cycles, methods, and best practices in coding.

The coding phase involves implementing ideas post-development, with plans like Agile and Waterfall being popular. Coding should be complete, clear, and simple, with efficiency checked before deployment. It is important to gain a detailed understanding of the process and how to put it into code, as well as how to put it into code. Computer engineers also play a role in computer networks and communications, which are the backbone of digital technologies. They work in areas such as computer architecture, operating systems, networks, software development, artificial intelligence, bioinformatics, telemedicine, digital signal processing, data warehousing, data mining, and web technology. In conclusion, computer engineers play a crucial role in the development of hardware, software, and computer networks, contributing to the growth and success of digital technologies. Digital technologies are a rapidly evolving landscape that encompasses devices and systems that use computerized procedures for data acquisition, processing, storage, and transmission. They are the cornerstone of modern societies and economies, playing a vital role in various sectors of their activities. The role of computer engineers is intended to provide practical skills and competences in the use of common digital technologies and deliver essential concepts and principles underlying digital technologies. A twofold complementary educational role is envisioned: vocational education (VE) and general education (GE). Cybersecurity and information assurance are critical fields within information technology, protecting digital information and systems from unauthorized access, damage, or theft. Encryptions, firewalls, antivirus software, and vulnerability assessments are essential for protecting against significant cybersecurity risks. Organizations must practice cybersecurity regulations to reduce risks and become more security aware. Zero trust architecture, based on the concept of "never trust, always verify," is a defense-in-depth cybersecurity architecture. Computer engineering is rapidly evolving, with emerging fields such as quantum computing and synthetic biology. These fields are still being tentatively explored by engineering departments, who are concerned about their disruptive potential. Their first field deployments to meet societal needs involve developing obfuscatory technologies. Computer engineers create technological solutions that change the world, but their ethical and professional responsibilities must be considered. They must be aware of the potential consequences of their work and take steps to ensure the ethical and professional development of their field [20].

Results and Discussion

Computer engineers have evolved significantly over the past few decades, with their responsibilities now encompassing hardware and software development, AI, and cybersecurity. They are now expected to possess a dual skill set, with strong foundations in both hardware and software. The growth of interdisciplinary technologies like IoT and cybersecurity has extended their functions to areas like embedded systems, data protection, and real-time data processing. Specializations within computer engineering include embedded systems design, network engineering, artificial intelligence engineering, cybersecurity engineering, and software development. Collaboration with other disciplines is crucial for successful design, development, and maintenance of technology solutions. The

impact of automation and AI is also undergoing a transformation, with engineers focusing on high-level problem-solving and innovation.

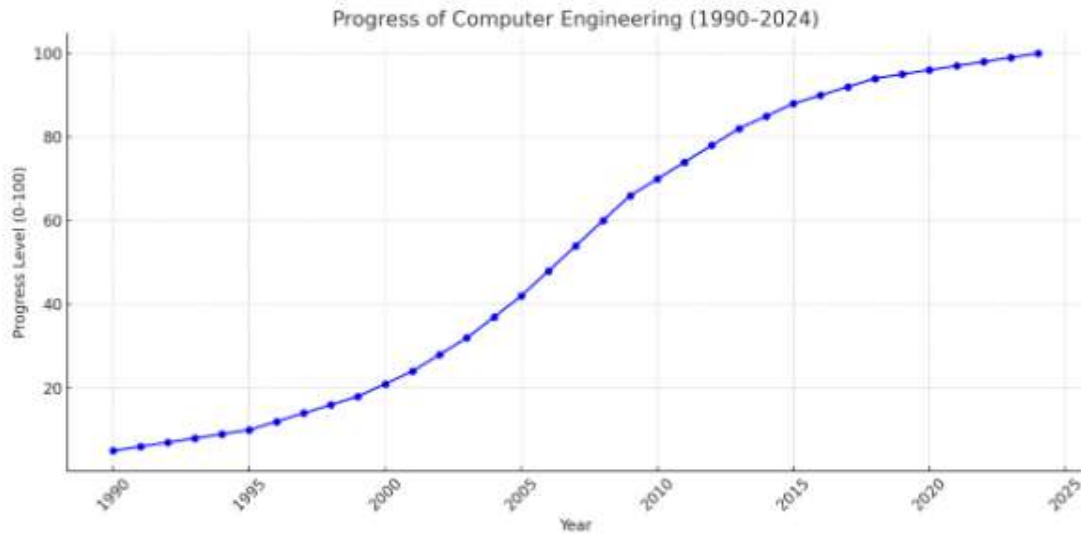


Fig.2 Overall analysis report

The study highlights the need for ongoing education and professional development to keep pace with technological changes and the ethical implications of technology. The role and functions of computer engineers are multifaceted and evolving, encompassing areas from hardware and software development to AI and cybersecurity.

CONCLUSION

In the era of AI and automation, the role of computer engineers is rapidly evolving from traditional system design and programming to driving innovation in intelligent technologies. They are now key contributors to developing smart algorithms, optimizing automation workflows, and ensuring ethical implementation of AI systems. As technology advances, computer engineers must continuously adapt, upskill, and embrace interdisciplinary collaboration to meet the growing demands of a digitized world. Their evolving responsibilities not only shape the future of computing but also influence the broader direction of society and industry. Computer engineers are responsible for the constantly changing technology, such as hardware and software, which are constantly evolving. The field of computer engineering focuses on the applications that run on machines, rather than the machines themselves. To succeed in this field, one needs a foundation in understanding new technologies and their role in the rapidly changing world. Ethical consideration and professional responsibility are essential for a computer engineer's career. Papers alone cannot provide a complete overview of the field, but they can provide a starting point. The wide world of applications is endless, and it is up to the user to find the one that interests them. Emerging advancements in hardware and software are shaping the future of technology. However, only a small part of resources on new and emerging technology is available, and there is a lack of definitions in online resources.

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