

A Prefatory Study on Role of Electrical Engineers on Healthcare

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Abstract

Engineering has had a significant role in improving and servicing the healthcare industry. For decades, professional groups, institutions, scientific writers, and the healthcare sector have used the phrase "Healthcare Engineering." However, the term "Healthcare Engineering" is still a bit of a misnomer. The goal of this position paper is to define Healthcare Engineering as an academic discipline, a field of study, a specialty, and a profession. Healthcare Engineering is described by what it is, who does it, where it is done, and how it is done, as well as its goal, scope, themes, synergy, education/training, contributions, and future prospects.

Keywords: Healthcare engineering, Role

Introduction

Engineering has played a critical part in the advancement of healthcare, bringing about revolutionary changes. Engineers from almost every engineering discipline, including Biomedical, Chemical, Civil, Computer, Electrical, Environmental, Industrial, Information, Materials, Mechanical, Software, and Systems Engineering, as well as healthcare professionals such as physicians, dentists, nurses, pharmacists, allied health professionals, and health scientists, have made contributions to support, improve, and/or advance any aspect of healthcare through eHealth. "Healthcare Engineering" is the most suitable word to describe such a multi-disciplinary specialty, given that the common purpose of all such engineering initiatives is to improve healthcare. However, there has never been a written precise and comprehensive definition of "Healthcare Engineering."

The American Society of Healthcare Engineering (ASHE) which was founded over 50 years ago, was one of the first to advertise the phrase "Healthcare Engineering." ASHE, as well as its

numerous local member organisations (e.g., has mostly focused on the physical environment of health care, which is just one aspect of what engineers accomplish in the field. In 1989, David and Goodman coined the phrase "healthcare engineers" in a research paper discussing the crucial role of engineers in the healthcare delivery system. The phrase "Healthcare Engineering" has been adopted by a number of academic programmes. However, each program's description/definition of "Healthcare Engineering" differs. Because each institution's programme is tailored to its own unique interests, strengths, focus, and concentration, each has its own description/definition. Each of these descriptions/definitions does a good job of capturing a certain aspect of Healthcare Engineering, but none of them captures all of the discipline's aspects. Furthermore, the Journal of Healthcare Engineering which was founded in 2010, focuses on all elements of healthcare delivery procedures and systems. The term "healthcare engineering" has also emerged in the commercial titles of healthcare firms with a variety of specialties.

The goal of this publication is to provide a clear and rigorous description of Healthcare Engineering as an academic discipline, a research area, a field of specialization, and a profession, as well as its future possibilities.

Technology has changed almost every aspect of our lives, from how we communicate to how we read the news, and from how we travel to how we order takeout. The technology-driven transformation that has just recently started to affect the health-care business is one area that the typical person still undervalues. Technology and analytical tools with unparalleled capability (such as artificial intelligence and machine learning) will lower costs, expand the reach of health care services, and save lives if they are applied wisely. However, specialists who are well-versed in both technology and health care are required to guarantee that capability is achieved during this formative phase of transition. In other words, healthcare systems engineers will be required in the future health-care system.

Engineers who work in healthcare systems are a crucial element of the engine that will propel health care ahead. They'll simplify operations, enhance how patients are treated, and discover cost-cutting efficiency. They'll achieve this in part by bringing dozens of key variables into their analytical orbits to test and investigate. Not long ago, most people who wanted to improve

health-care procedures could only concentrate on a handful of these characteristics.

Healthcare Engineering

This section defines healthcare engineering in terms of what it is, who does it, where it is done, and how it is done.

A more detailed definition may be derived from "healthcare," which is defined as "the preservation and enhancement of physical and mental health, particularly via the provision of medical services". "Through the services provided by the medical and allied health professions, the prevention, treatment, and management of sickness, as well as the maintenance of mental and physical well-being."

Healthcare engineering encompasses all elements of sickness prevention, diagnosis, treatment, and management, as well as the preservation and enhancement of physical and mental health and well-being, as provided by medical and allied health professionals to humans.

Engineering for Healthcare Intervention

"Any sort of therapy, preventative care, or test that a person might take or experience to enhance health or to aid with a specific disease," according to the United States Department of Health and Human Services (USDHHS). Drugs, meals, supplements, immunizations, screening tests, workouts, hospital treatment, and some types of care (such as physical therapy) are all examples of healthcare interventions, according to the USDHHS.

Surgery

Almost every facet of surgery, from operating room architecture to the devices used there, is dependent on engineering. Engineers build small cameras and lighting systems to implant into the body for keyhole surgery and other minimally invasive treatments. Endoscopes (inside-the-body probes) and other equipment let surgeons to operate on patients via small incisions, allowing for significantly faster healing and recovery than conventional surgery. Medical robots are already in use in ophthalmology, prostate surgery, orthopedic surgery, cardiac surgery, and other fields of surgery, guaranteeing that fewer errors are made and that physicians may meticulously design surgical operations knowing that the robot will carry them out.

More accurate diagnosis and treatment

Magnetic resonance imaging (MRI) and computed tomography (CT) devices are being utilized to examine the insides of human bodies and identify medical problems. Electromagnetic acoustic imaging is a novel method being introduced by the area of electrical engineering (EMAI). EMAI "induces ultrasonic emission using long-wavelength RF electromagnetic

Waves," according to the Institute of Electrical and Electronics Engineers (IEEE), and "can create high-quality pictures and identify tumors as small as 2 millimeters in diameter."

EMAI devices are not only more accurate, but they are also more portable and less costly than MRI and CT scanners. Nanotechnology, according to the IEEE, may improve the precision of therapies for deadly illnesses like cancer. "Such technologies are being developed to identify and attack circulating tumor cells as well as cure brain and spinal-cord damage after a stroke," according to the IEEE.

A medical imaging procedure known as radiography is an X-ray. It creates pictures of structures within the body using very small quantities of electromagnetic energy. Following that, the photographs may be seen on film or digitally.

X-rays are often used to examine bones and teeth, making them useful in the diagnosis of fractures (broken bones). An X-ray may also be ordered to examine organs and structures within the chest, such as the lungs, heart, breasts, and abdomen.

Innovative health-care technology

Health-care technology advancements imply possible advances in human life. Electrical engineering may help enhance present health-care standards by providing technologically improved techniques. For example, electrical engineering may aid in the development of robots that can compensate for human flaws, such as surgical robots. To compensate for the reality that people may make mistakes under duress, they can simply direct a robotic arm to avoid making mistakes.

As a result, robots may be employed to transform difficult operations into relatively simple, minimally invasive treatments. This might save expenses for patients and avoid medical issues in addition to making these treatments simpler for surgeons. Robots may also play a significant part in patient care at home if the patient has a serious communicable condition such as COVID-19, which poses a high risk of infection for the caregiver.

Improvements in the patient experience

Engineer-designed technology is helping to enhance the patient experience as well as advance the area of health care. Patients may check their health from the comfort of their own homes with the aid of certain modern technologies. Not only is this handy, but it may also save patients hundreds of dollars by eliminating the need for these tests to be conducted in the doctor's office.

This is a significant advantage for patients who are looking for ways to save money wherever they can. Patients may use the time and money saved on these sorts of medical tests to go to the doctor for more necessary appointments, such as treatment, or to obtain preventive care to avoid more expensive treatments in the future.

Electrical Installation and patient safety

Electrical Engineers should use a risk management method to improve the safety of electrical installations, according to the international standard and several additional recommendations. In this method, clinical locations are divided into three groups based on the treatment's criticality and whether a power outage would jeopardise patient safety. Group 0 and Group 1 sites, for example, are low and intermediate risk regions, respectively, where any medical equipment would only come into touch with the patient's exterior body parts. Any loss of electricity for more than 15 seconds in these two kinds of sites is not acceptable, even though it does not always jeopardise patient safety and does not risk life. Group 2 locations, on the other hand, are high-risk areas where medical equipment must make prolonged contact with a patient's internal body parts and where a loss of power could be fatal. As a result, the adoption of Isolated Power Systems is required to reduce the risk of electric shock. Furthermore, power outages of more than 0.5 seconds cannot be tolerated, necessitating the use of external Uninterrupted Power Supplies (UPS) or internal batteries.

PROSPECTS

Healthcare is predicted to remain one of the world's biggest and fastest-growing sectors, and demand for Healthcare Engineering specialists will rise in tandem. Healthcare Engineering is expected to play an increasingly important role in almost every aspect of healthcare as it changes rapidly and becomes increasingly complex as a result of technological, economic, social, and regulatory influences. It is also expected to be a major factor in healthcare advancement. Healthcare Engineering professionals will face challenges related to issues such as the continued rise in healthcare costs, healthcare quality and safety, ageing population care, common disease management, the impact of high technology, regulatory compliance, risk management, and reducing litigation risk. They will be crucial in designing, developing, and deploying cutting-edge technologies and systems resulting from breakthroughs in electronics, information technology, miniaturization, material science, optics, and other disciplines. Healthcare Engineering will be recognized as the most important profession where engineers make major contributions directly benefiting human health as technology continues to create new areas for engineers to work in healthcare, and the fusion of engineering and health sciences leads to a greater demand for engineers.

CONCLUDING REMARKS

We anticipate that by presenting a definition of Healthcare Engineering as an academic discipline, a research area, a field of specialization, and a profession, this document will have an impact on the following:

- Increasing the visibility and prestige of Healthcare Engineering.
- Assisting students in deciding on a degree in Healthcare Engineering.
- Assisting engineers and healthcare professionals in deciding whether or not to pursue a career in healthcare engineering.
- For the scientific community, funding agencies, and conference/event organizers, defining Healthcare Engineering as a specialty area.

- Assisting in the correct categorization of Healthcare Engineering jobs in job search databases.
- Assisting healthcare organisations in finding qualified candidates.
- Bringing Healthcare Engineering to the attention of university administration when evaluating new programme start-ups.

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