Integrating Artificial Intelligence in Electrical Engineering Education: A Framework for the Fourth Industrial Revolution

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Abstract. The advent of the Fourth Industrial Revolution (4IR) demands a paradigm shift in engineering education, necessitating the integration of Artificial Intelligence (AI) in Teaching, Learning, and Assessment (TLA). This research highlights the imperative need for Higher Education (HE) institutions to adapt their curricula and teaching practices to prepare students for an AI-driven market. The study focuses on integrating AI into the electrical engineering curriculum, emphasising the need for curriculum redesign and the incorporation of interactive learning experiences as core components of this transformation.
The research showcases specific examples of AI integration into the electrical engineering curriculum, such as Machine Learning (ML)-based project design and simulation tools. While acknowledging the challenges of algorithmic bias, data privacy, and societal impact associated with AI, the research emphasises the crucial role of interdisciplinary collaboration and robust monitoring frameworks to ensure responsible AI integration.
This paper provides a framework for HE institutions to redesign their electrical engineering programs, incorporating AI and aligning with 4IR demands. By doing so, students are equipped with the cognitive skills required to thrive in an AI-driven market, enhancing critical thinking and problem-solving capabilities. The proposed framework addresses potential implementation barriers, such as faculty training and infrastructure needs, offering strategies to overcome these obstacles and ensure a seamless transition to an AI-integrated educational model

Keywords: Artificial Intelligence (AI), Fourth Industrial Revolution (4IR), Electrical Engineering Education, Teaching, Learning, and Assessment (TLA), Curriculum Design

1 Introduction

The Fourth Industrial Revolution (4IR), characterised by the convergence of physical, digital, and biological systems, has ushered in a transformative era that has significantly impacted various industries, including the engineering sector [1–3]. The rapid advancement of technologies such as Artificial Intelligence, the Internet of Things, and advanced robotics has fundamentally altered engineering systems and processes, necessitating a corresponding shift in engineering education [4–6]. To meet the evolving professional requirements higher education institutions must adapt their curricula and

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and teaching practices to prepare students for an AI-driven market. Electrical engineering, as a critical field within the broader engineering discipline, faces the imperative to integrate AI into its educational framework.

Numerous studies have highlighted the potential benefits of incorporating AI in education, including improved student engagement, personalised learning, and enhanced assessment practices [1, 3–8]. Moreover, the integration of AI in the electrical engineering curriculum can lead to more robust problem-solving skills, data-driven decision-making, and the ability to leverage cutting-edge technologies in design and simulation.

However, the integration of AI in education is not without its challenges. Concerns regarding algorithmic bias, data privacy, and the societal impact of AI must be addressed through interdisciplinary collaboration and robust monitoring frameworks [5, 6, 9]. Challenges specific to South Africa include funding, infrastructure, and skills to produce employable graduates. The government is expected to provide funding to develop infrastructure and make available the required resources to build capacity in an education system to adapt to 4IR and AI [10].

This research paper presents a comprehensive framework for integrating AI into electrical engineering education, aligning with the demands of the 4IR. The framework encompasses curriculum redesign, interactive learning experiences, and strategies to overcome implementation barriers, ensuring that electrical engineering students are equipped with the necessary cognitive skills to thrive in an AI-driven market.

2 State of the Science in Electrical Engineering Education

The intersection of electrical engineering education, the Fourth Industrial Revolution (4IR), and Artificial Intelligence (AI) is a burgeoning field of research. While there is growing recognition of the need to adapt electrical engineering curricula to the demands of the 4IR, the integration of AI is still in its infancy.

Existing research highlights the potential of AI to enhance various aspects of education, including personalised learning, intelligent tutoring systems, and automated assessment [11–13]. However, studies specifically focused on AI integration in electrical engineering education are relatively limited.

A critical analysis of the current state of electrical engineering education reveals some gaps and challenges. Electrical engineering education is currently grounded in traditional methodologies that may not fully address the dynamic needs of the 4IR. Traditionally, electrical engineering curricula have focused on the fundamentals of circuit analysis, electromagnetic theory, and power systems. Thus, the curricula often prioritise theoretical knowledge over practical application, limiting students' ability to tackle real-world problems. However, in the context of the Fourth Industrial Revolution, these core competencies must be complemented by a deeper understanding of AI-enabled technologies, data analytics, and the integration of smart systems [5, 6]. Furthermore, the rapid pace of technological advancement necessitates a curriculum that is flexible and adaptable to emerging trends. There are gaps in the current curriculum design and TLA practices, including a lack of emphasis on AI, insufficient hands-on learning experiences, and limited interdisciplinary collaboration. These gaps hinder the development of critical thinking and problem-solving skills necessary for the modern engineering landscape.

Electrical engineering, as a critical field within the broader engineering discipline, has undergone significant transformations in recent years, driven by the advancements in Artificial Intelligence, the Internet of Things, and advanced robotics [14]. These technological innovations have profoundly impacted the way electrical systems are designed, optimised, and maintained, necessitating a corresponding shift in engineering education. While foundational knowledge remains crucial, the integration of AI and other emerging technologies into the curriculum is imperative. It is of critical importance to incorporate AI-based technologies and pedagogical approaches in electrical engineering education. The emphasis on data-driven decision-making, problem-solving, and the ability to leverage cutting-edge technologies in design and simulation underscores the need for a comprehensive framework to guide the integration of AI in electrical engineering programs [15].

To meet the evolving professional requirements, electrical engineering programs must adapt their curricula to incorporate AI-based tools or technologies and pedagogical approaches that prepare students for the evolving professional demands. Hence, providing students with the necessary skills to thrive in an increasingly technology-driven industry.

The integration of AI in electrical engineering education can significantly enhance student learning experiences, enabling them to engage in more realistic problem-solving, data-driven decision-making, and the exploration of complex engineering systems [5]. Additionally, the incorporation of AI-based assessment and feedback mechanisms can lead to more personalized learning experiences, improved academic performance, and the development of critical thinking and problem-solving skills.

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3 AI Integration in Electrical Engineering Education

The Fourth Industrial Revolution (4IR) has ushered in a new era of technological advancements, profoundly reshaping the educational landscape. Educational institutions must adapt their curricula and teaching practices to prepare students for an AI-driven market.

3.1 Integrating AI in Electrical Engineering Education: A Conceptual Framework

The integration of AI in electrical engineering education requires a multifaceted approach that addresses curriculum redesign, interactive learning experiences, and implementation strategies. The process for the successful integration of technology in education extrapolated from Sibanda and Naidoo[16] is illustrated in Fig. 1.

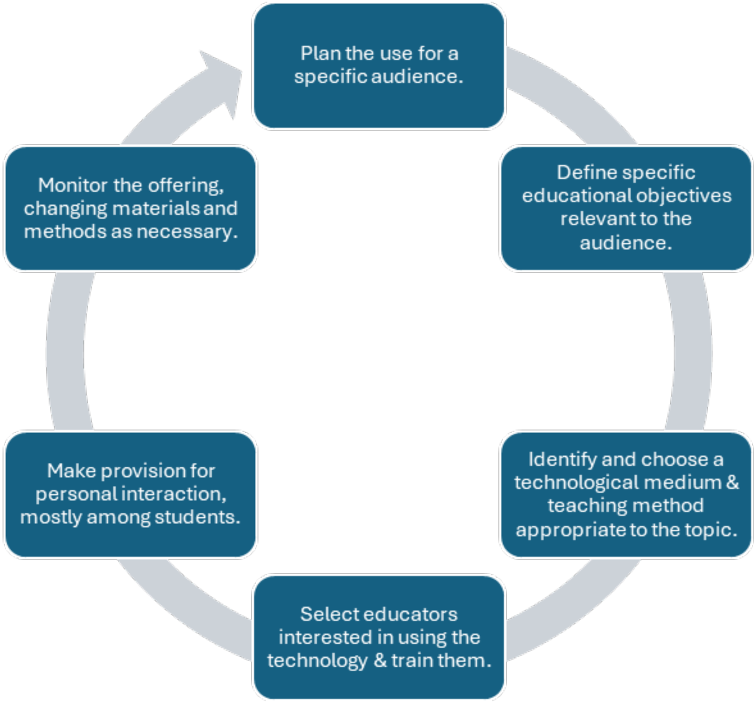

Fig. 1. Process for the successful application of technology in education.

The rapid advancements in AI, the Internet of Things, and advanced robotics have transformed the engineering profession, necessitating a fundamental shift in the delivery of electrical engineering education. To meet the evolving professional requirements, educational institutions must develop a comprehensive framework for integrating AI into their electrical engineering curricula.

This framework (Fig. 2.) should encompass the following key elements:

- Curriculum redesign: Incorporating AI-based technologies, algorithms, and programming languages into the core electrical engineering curriculum. This includes the integration of AI-powered tools for simulation, optimization, and decision-making in courses such as circuit analysis, control systems, and power systems.
- Interactive learning experiences: Providing hands-on learning opportunities through the use of AI-driven laboratory simulations, virtual/augmented reality, and interactive visualizations. These experiential learning activities will enable students to apply AI-based solutions to real-world engineering problems.
- Responsible AI integration: Addressing the ethical, social, and regulatory implications of AI integration in engineering practice. Incorporating top-

ics related to algorithmic bias, privacy, and the societal impact of AI-powered systems into the curriculum.

- Overcoming implementation barriers: Addressing the challenges associated with the integration of AI, such as faculty training, technological infrastructure, and institutional policies.

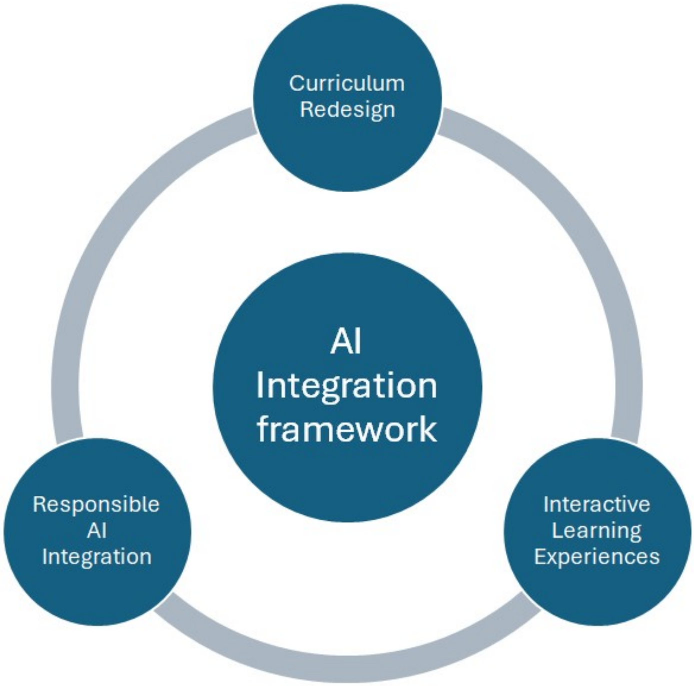

Fig. 2. Framework for integrating AI into the electrical engineering curriculum

This comprehensive framework will empower electrical engineering programs to produce graduates who are well-equipped to navigate the Fourth Industrial Revolution, leveraging AI-powered technologies to solve complex engineering challenges.

To summarize, the integration of AI in electrical engineering education is crucial to prepare students for the evolving professional landscape shaped by the Fourth Industrial Revolution. By implementing a comprehensive framework that addresses curriculum redesign, interactive learning experiences, responsible AI integration, and overcoming implementation barriers, educational institutions can equip their students with the necessary skills and knowledge to thrive in an AI-driven world [17].

3.2 Curriculum Redesign for AI Integration

The Engineering Council of South Africa (ECSA), mandated by the Council of Higher Education (CHE), is responsible for quality-assuring engineering programmes. ECSA provides qualification standards to which institutions offering engineering programmes must conform. Institutions offering a diploma programme must conform to ECSA's E-02-PN [16]

Diploma engineering students need to demonstrate competence it the following graduate attributes [18]:

- Graduate Attribute 1: Problem-solving
- Graduate Attribute 2: Application of scientific and engineering knowledge
- Graduate Attribute 3: Engineering design
- Graduate Attribute 4: Investigations, experiments and data analysis
- Graduate Attribute 5: Use of engineering tools
- Graduate Attribute 6: Professional and technical communication
- Graduate Attribute 7: The engineer and the world
- Graduate Attribute 8: Individual and collaborative teamwork
- Graduate Attribute 9: Independent learning ability
- Graduate Attribute 10: Engineering professionalism
- Graduate Attribute 11: Project management and finance
- Graduate Attribute 12: Workplace practices

In order to comply with the required GA's in the respective assessments, the educators are expected to access the appropriate resources to integrate them into their classroom, to facilitate students acquiring the prescribed knowledge and skills sets. This paradigm shift creates an essential pedagogy modification, to integrate updated technology into the teaching, learning and assessment processes, thereby introducing an e-pedagogy structure.

The integration of AI into the electrical engineering curriculum requires a holistic approach to curriculum redesign. This process should involve the following key elements:

- Identification of AI-related knowledge and skills: Determine the essential AI concepts, tools, and techniques that should be incorporated into the electrical engineering curriculum to align with industry demands.
- Curricula integration: Seamlessly integrate AI-related content across various courses, ensuring that students develop a comprehensive understanding of how AI can be applied in electrical engineering applications.
- Pedagogical approaches: Adopt interactive and experiential learning methods, such as project-based learning, case studies, and AI-driven simulations, to engage students and enhance their problem-solving and critical thinking skills.
- Assessment and evaluation: Develop assessment strategies that evaluate students' proficiency in AI-related knowledge and skills, including their ability to apply AI-based solutions to engineering problems.

Electrical engineering curricula must be reimagined to incorporate AI-driven concepts and applications throughout the program. This includes the integration of Machine Learning, Deep Learning, and Natural Language Processing into core courses, as well as the development of new electives that focus on the intersection of AI and electrical engineering [17].

For example, students may be required to complete a course on "AI-Driven Electrical System Design" where they learn to leverage Machine Learning algorithms for optimising power distribution, predictive maintenance, and grid automation. Similarly, a "Robotic Systems and Control" course could expose students to the application of AI in the design and control of advanced robotic systems.

3.3 AI-Driven Learning Experiences

In addition to curriculum restructuring, electrical engineering education must transition towards more interactive and AI-driven learning experiences. Simulation tools that incorporate AI-based algorithms can provide students with hands-on opportunities to design, test, and optimise electrical systems [19, 20]. Furthermore, the integration of AI-powered tutoring systems and adaptive learning platforms can enhance personalised instruction and real-time assessment of student progress.

By incorporating these interactive learning experiences, students can develop essential skills such as critical thinking, problem-solving, and data analysis - all of which are crucial for thriving in an AI-driven electrical engineering landscape. These experiences may include:

- AI-powered laboratory simulations: Develop virtual or augmented reality-based simulations that allow students to interact with AI-powered systems, such as smart grid management, robotic control, or autonomous vehicle design.
- AI-assisted project-based learning: Integrate AI-based tools and algorithms into engineering design projects, enabling students to leverage AI for tasks like optimization, decision-making, and data analysis.

3.4 Overcoming Implementation Barriers

The successful integration of AI in electrical engineering education requires addressing potential implementation barriers, including faculty training, infrastructure needs, and institutional policies.

To ensure that faculty members are equipped to deliver AI-integrated curriculum, comprehensive professional development programs must be implemented. These programs should focus on upskilling instructors in AI concepts, best practices for AI integration, and strategies for leveraging AI-powered educational tools.

Additionally, institutions must invest in the necessary infrastructure, such as high-performance computing resources, robust data management systems, and user-friendly AI development platforms.

By addressing these implementation barriers, institutions can create an enabling environment for the seamless integration of AI in electrical engineering education, preparing students for the demands of the Fourth Industrial Revolution.

3.5 Framework Implementation Expected Outcomes

The implementation of the proposed framework for integrating AI in electrical engineering education is expected to yield the following outcomes [21]:

- Enhancement of students' problem-solving and critical thinking skills through the use of AI-powered tools and simulations;
- Increased engagement and motivation among students due to the adoption of interactive and immersive learning experiences;
- Improved alignment of electrical engineering curricula with industry demands, ensuring that graduates are prepared for the evolving technological landscape;
- Development of faculty expertise in AI-integrated teaching and learning, fostering a culture of innovation and continuous improvement;
- Establishment of a flexible and adaptable educational ecosystem that can keep pace with the rapid advancements in AI technology.
- Improvement in students' understanding of AI concepts and their ability to apply them in electrical engineering applications

By realizing these outcomes, electrical engineering education will be better positioned to produce graduates who are equipped with the necessary skills and knowledge to contribute to the Fourth Industrial Revolution.

4 Pedagogical Approaches

The integration of AI in electrical engineering education requires the adoption of innovative pedagogical approaches that leverage the strengths of AI-powered tools and technologies. These approaches should emphasize interactive, experiential, and data-driven learning to equip students with the necessary skills and knowledge to thrive in an AI-driven professional landscape.

4.1 Problem-Based Learning (PBL):

Problem-Based Learning (PBL) facilitates the process of students working and solving real-time applications by finding engineering solutions. Finding solutions may not necessarily be engineering-based. PBL intends to inculcate the culture of finding engineering solutions to identified problems using principles of 4IR and AI systems. This approach promotes critical thinking and practical application of theoretical knowledge. In engineering the process of root cause analysis is vital in the case of breakdowns, to minimise downtime and avoid loss of profits. Design in engineering programmes is applied with the use of technology in our digital age, which augments interaction in both real and virtual environments. Due to practical work being accomplished in simulations most times, students need to be able to relate simulated results with real-time applications, using different data analysis and e-cloud computing. Educational technology facilitates diversity in all engineering disciplines to promote a reasonable level of analysis and synthesis of data [22].

4.1.1 Real-World AI Problems:

Engineering problems are normally complex due to the different disciplines involved thus resulting in real-world AI challenges. The challenges could be to derive a model based on ML or create a knowledge-based algorithm. Solutions to such problems will entail the use of knowledge and skills in Science, Technology, Engineering and Mathematics (STEM). External collaboration with industry and research institutes forms part of the pedagogy to familiarise students with the real world to bridge the gaps between the academic programme and industry. A major milestone in the journey of a student is to work on practical projects in real time.

4.1.2 Student-Centred Learning (SCL):

Students need to always participate actively in their learning process. It is only they who can identify how they can find a solution to a problem. In this way, they learn to work independently. SCL is a teaching method that places the students' learning interests as the objective, creating a more stimulating educational environment. The best way is to structure the learning sessions in their interest, maintaining their concentration, to create a teaching and learning environment for students to participate in discussions and the material. SCL may mean that the educator plays the role of offering direction but promoting the active participation of students. One way is to constantly ask questions as the teaching process takes place. This ensures that students are engaged in the learning process.

There is a need for educators to develop their skills to teach 4IR and AI technology since they teach from a syllabus, with no direct exposure to such technology. This is to maintain the phenomenal technological advancement in industry. Institutions are expected to acquire industry-related technologies to build capacity in educators, to deliver to students. 4IR makes it essential for both educators and students to adopt creative thinking. Knowledge and skills of graduates of the future makes it compulsory to learn in new ways to upgrade themselves appropriately due to 4IR and AI [23].

4.1.3 Collaborative Group Work:

Students are expected to perform as individuals and as team members, in engineering. As such students are encouraged to work as individuals and as a group member, to complete any task. This builds capacity to work with other people, improves communication skills, promotes the sharing of knowledge and skills, leading to more effective solutions. This approach also encourages greater equality and transparency since all members is a designated task are aware of each other's roles and responsibilities. Whilst collaborative group work may focus on the students, the educators must be equally regarded as a member of the group to maintain continuity. Very often the students in the group can be misled by their group leader. This is where the educator is required, as the responsible person, to achieve the desired outcome/s. Educators may not require in depth training in 4IR or AI systems but rather to have an overview of the technology. However, it is recommended that educators have a thorough understanding to guide student where aspects of critical thinking and root cause analysis is required. AI and blockchain can be implemented in the educational administrative processes for recording and monitoring assessments. This may contribute to making recommendations for improvement. Transparent and consistent records are available on the blockchain, creating efficiency in completing tasks. AI, together with ML, is capable of training a system to respond to areas of attention for continuous improvement in future work [7].

4.1.4 Integration of Knowledge and Skills:
During the teaching and learning process it is expected of students to acquire the required knowledge in the classroom lectures. This is the first component of that process. Since engineering is an applications-based field, the acquired knowledge is meaningless, until it is applied, practically. Hence the second component is to develop skills. This is achieved through workshops or laboratory work where the theory learnt is applied on a practical 4IR or AI environment. Concepts of augmented learning, neural networks, FLC or ML are tested on practical, simulated, then real-time applications. This integration of knowledge and skills completes the learning process, thereby supporting students to relate with their academic work and prepares them for the world of work.

"Relative advantage" is a term that refers to an end user who adopts a novelty and appreciates the benefits thereof. The level of appreciation is based on its appropriateness in the environment of the end user. It is normal that when the outcome is interpreted as beneficial is the novelty adopted. This principle is applied in the teaching and learning environment. To successfully integrate knowledge and skills the adopters at one level, will be students and educators who have the knowledge to appreciate its application, to appreciate its benefits. However, the critical component are the implementers, who are the responsible for making the appropriate facilities available for 4IR and AI. This group may not understand and appreciate the benefits. Hence this remains a challenge [24].

4.1.5 Self-Directed Learning:
Students are expected to work independently. Hence the teaching and learning process needs to inculcate this culture of independent learning. Very often, students follow others who commence with assigned tasks. This prevents them from identifying their learning needs. It is only when they know and understand their needs, will they be able to establish their own goals. This will prompt them to locate the necessary resources, for their purpose. In this way, students develop lifelong learning skills. Student need to be aware that the habits they develop in their learning process, grows with them with time. This approach inspires them to develop a sense of responsibility in their education.

4.1.6 Reflective Practice:
Students are expected to reflect on the knowledge and skills that the acquire. It is a process of 'stock-taking', meaning that they need to sit back and think about the knowledge and skills they have obtained. A reflection approach develops cognitive levels associated with like root cause analysis and critical thinking to improves prob-

lem-solving skills. It must be noted that daily in an engineering work environment, the critical skills may not be required due to engagement in project or developmental work. It becomes demanding in the case of a breakdown or any unusual occurrence, that the critical skills will be required. It is the reflective practice, that contributes to development of this cognitive levels.

4IR or AI in electrical engineering demands such cognitive levels. Different algorithms in the software, with variations in hardware configurations require specific components. The control algorithm of an AI application may build a dynamic model directly, without simulation, by using Matlab System Identification Toolbox, accessing real-time plant data. On the other hand, an AI application that requires a mathematical model will require simulated data to be analysed. The derived analysis may be applied to a rule-based algorithm to test performance, before real-time implementation [12].

4.2 Blended Learning:

The teaching and learning process can be optimised in a blended learning environment, by combining conventional instruction methods with online facilities. This method becomes more practical in the 4IR and AI space, to provide a more interactive environment for the learner. In the classroom there are sections of the syllabus that requires the physical interaction between educator and students. Covering theoretical aspects like engineering standards and drawings are better taught on an online platform by sharing the screen, with the same interactive experience, online. On the practical tasks, it is essential for a physical teaching and learning process. However, 4IR and AI software components are better covered in an e-learning environment, to keep all students learning at the same pace. Provision is made for representation of hardware components, to simulate results, if need be. The e-platform develops computer skills as well, amongst the required IT knowledge. It is impossible to teach all the required skills in scheduled periods to students. As such, work can be covered at any time on 4IR or AI-driven learning tools, to build capacity effectively.

4.3 Industry Partnerships:

Students complete their study period at the institution, to serve industry, primarily. As such, the institution is expected to establish partnerships with industry. However, this is the responsibility of the leaders in both sectors. Very often industry is committed with day-to-day responsibilities, to meet various targets, with little or no time for educational institutions. It is unfortunate that when students fail to live up to the expectations of industry, it becomes a concern of where the fault lies. At the same time leaders of educational institutions are engaged with coordinating the academic terms, trying to meet deadlines to have student results available on time, that there is little or no time to engage with industry. It lies in the hands of the leaders to establish Memorandum of Agreement (MoA), to guide line managers and supervisors to implement such mechanisms. The educators and students, together with the respective industry personnel can effectively implement the plan of action. This makes provision to bridge the gap between education and industry, facilitating students to benefit out of training and development programmes, structured and focused on the needs of the end user, i.e. industry, where students enter with expectations. Industry have expectations from students and students have expectations from industry.

5 The Mangosuthu University of Technology (MUT) Case

AI and the 4IR are increasingly being integrated into higher education in various forms. In the department of electrical engineering at MUT, AI has been implemented in research and the classroom in automation and control, using rule-based algorithms to optimise industrial systems. Siemens FuzzyControl++, an industrial software with S7-300 Programmable Logic Controller (PLC), industrial hardware, and Matlab Fuzzy Logic Toolbox, a mathematical modelling platform was used on a typical industrial process. A rule-based algorithm built on human reasoning, was configured in a Fuzzy Logic Controller (FLC). Evidence showed how an intelligent system overcomes challenges in traditional control. Traditional control is mathematically based making it impossible to illuminate process fluctuations. However, an AI-based control strategy functions on a set of rules for selected process conditions, eliminating the fluctuations.

4IR has been implemented using delivery of knowledge in the classroom and acquiring skills in laboratories, to reinforce student understanding of the technology. Siemens Totally Integrated Automation (TIA) Portal, an industrial software with S7-1200 PLC, industrial hardware was used in scheduled practical classes. Students learnt the concept of the evolution of technology by understanding the paradigm shift of engineering software and hardware into the era of AI and 4IR. In terms of software Step7 version 5.2 only could programme the automation or control task. To create a Graphical User Interface (GUI) for the operator to interact with the process, a dedicated Supervisory, Control and Data Acquisition (SCADA) component is required. TIA comprises a combined PLC-SCADA system, demonstrating the concept of 4IR technology, on how fewer components are required. In terms of hardware the S7-300 has limited communication options with field devices and other control devices via Profibus. S7-1200 could communicate via ethernet, facilitating complex and higher-level networking capability, to communicate with more devices, other than engineering.

The application of AI across various aspects of everyday life demands a deeper understanding of its applications to allow us to appreciate how to use it, to experience its full potential. Like the computer, many of us do not use certain applications to its full potential due to us not understanding how it works. However, AI has direct impact on various aspects like our lives at home, in the workplace, banking etc. Hence a deeper understanding becomes essential. Whilst the 4IR and AI have made life easier, so come the challenges like cyber threats, etc. Some of us have experienced increasing challenges with our banking apps, each time being cautioned by the banks of new scams. Hence the need to educate across all areas to facilitate a population experiencing the benefits of AI and 4IR, to benefit in this our continuously developing AI-empowered era. Although there is speculation that a basic understanding of AI is not required, for those who have hands-on experience, it is found that fundamental knowledge facilitates better understanding, for maximum benefits. In the education sector, greater opportunities are created for researchers, engineers and technically inclined personnel who work with data and information, ML, deep learning, and other AI systems, to provide an AI platform that will indeed benefit us all. This may not necessarily mean that every student should have the highest qualification in AI or ML. Like any study route, be it primary or secondary school, or university level, the fundamental component is always essential to support understanding. Hence the need for institutions, departments and industry at large, to collaborate, for students to experience the multi-skilled and integrated knowledge approach. It becomes the responsibility of institutions to provide the mechanisms to build capacity and educators to implement AI in the educational sector by actively preparing students for the world of work. 4IR and AI are currently restricted to being incorporated within the curriculum of Science, Technology, Engineering and Mathematics (STEM) disciplines. While these are the most pertinent disciplines, where the fundamentals of 4IR and AI reside, disciplines in other study fields require these components. Institutions of higher education currently have very limited 4IR and AI components in their existing programs. AI is a set of tools that require knowledge and skills to produce optimal benefits. AI must be built into the core, fundamental and elective cognitive components in the curriculum. There must be progression from existing programmes into a revised framework to avoid any gaps in the knowledge areas [11].

6 Conclusion

The Fourth Industrial Revolution has ushered in a new era that necessitates a fundamental shift in electrical engineering education. By integrating Artificial Intelligence into the curriculum, interactive learning experiences, and implementation strategies, higher education institutions can equip electrical engineering students with the necessary skills and competencies to thrive in an AI-driven market.

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