INTERNATIONAL JOURNAL OF EDUCATION AND INFORMATION TECHNOLOGIES
DOI: 10.46300/9109.2025.19.3 Volume 19, 2025

Legal Challenges of Humanizing Robots. A Study of the Responsibility and Autonomy of Robots Equipped with Artificial Intelligence

Mohamed F. Shehta[1], Usama M. Ibrahem[2,3,*], Gamal S. Khalifa[1]
[1]Department of Law, Faculty of Sharia and Law,
University of Ha'il,
Saudi Arabia

[2]Educational Technology Department,
Education College University,
University of Ha'il,
Saudi Arabia

[3]Educational Technology Department, Ismailia Education College,
Suez Canal University,
Egypt

**Corresponding Author*

Received: April 29, 2024. Revised: November 13, 2024. Accepted: December 15, 2024. Published: February 25, 2025.

Abstract—Recent decades have witnessed significant developments in smart robotics and other artificial intelligence technologies. Robots are no longer just machines that carry out specific commands; rather, thanks to artificial intelligence (AI) algorithms, they can interact with humans and make decisions independently. This is particularly true because the programming of these robots enables them to grow and learn from their own experiences. The enormous capabilities that robots were able to possess led them to replace humans in most places and professions, which gave rise to the term "humanization of the robot" to refer to human-like robots that can make decisions and interact socially in a way that mimics human behavior. However, the real problem with this development lies in two parts. This research aims to explore the legal implications surrounding the autonomy and accountability of AI-equipped robots, focusing on how existing laws can adapt to address issues of responsibility in human-robot interactions. First, this development presents both advantages and disadvantages. The robot that helps humans perform their tasks better can unpredictably transform at any moment into an undeterrable and unstoppable human-killing monster. The second issue is that international jurisprudence has yet to establish a legal framework that defines the legal nature of these robots and confines them to a specific set of controls and laws. It also obliges their makers, programmers, and owners to adhere to these controls. In addition to previous legislation, the theory of the "responsible human representative" must be applied, which stipulates that they legally bear civil, tort, and criminal liability for what their robots do.

Keywords— Robots; Legal Personality; Robot Humanization; Artificial Intelligence (AI); Legal Liability; Criminal Liability.

I. INTRODUCTION

This literature review provides an inventory of key issues as it explores the intersection of AI and robotics and highlights the associated legal and ethical challenges. It also examines professional practice and accountability, particularly the issues of liability. It dedicates a significant portion to analyzing current legal frameworks and advocating for updated regulations to effectively oversee AI integration in human daily life. We provide real-world case studies to illustrate practical challenges and the legal implications of AI in legal settings.

Based on prior studies, we need to define the "humanization" of robots, including ethical and social consequences. We must

also examine the legal frameworks governing AI and robotics to identify liability and legal duty gaps [1], [2]. We should examine high-profile AI and robot cases to understand how courts have handled autonomy and liability [3]. It's also important to examine autonomous robots' ethical dilemmas, especially in decision-making situations that affect human lives, and to compare how different countries have handled the legal issues related to manned robots, considering differences in legislation and cultural attitudes [4], [5] Discussing future legal reforms to integrate AI technology into society is also crucial [2].

1. The concept of a human-like robot equipped with AI algorithms This section delves into the concept of human-like robots augmented with AI algorithms. By providing clear definitions and examining the multi-faceted nature of these robots, it aims to shed light on their operational mechanisms, historical origins, and the broader implications they have on the future of human-machine interactions. The goal is to equip readers with a comprehensive understanding of how human-like robots are defined, developed, and distinguished within the scientific community and to elucidate their potential roles in transforming various aspects of human life [5].

Scientists have been interested in studying robots, establishing their definitions, characteristics, prospects, and difficulties, as well as manufacturing and developing them, due to the significant scientific advancements that have brought robots into the mainstream of human life.

Robots can be defined as “multi-purpose and multi-task machines, provided with memories and limbs, to perform pre-determined sequential movements, making them capable of moving, rotating, and performing many tasks in place of the human worker through the automatic performance of their movements” [6], [7].

Contrary to popular belief, the term "robot" encompasses more than just human-shaped industrial structures under the umbrella of "robotics" or "robot." Rather, the concept of a robot expands to include all active structures and machines that move independently and freely; they work around us through the energy and information they receive with their sensors and artificial sense devices. Whether the external structure of these structures represents a human form or takes the form of a means of transportation such as smart cars, trains, drones, or any other form [8], [9] is a matter of debate.

As for the first use of the word robot in the twentieth century, it goes back to the Czech playwright Karl Čapek, who used it in 1920 in his play “Rossum’s Universal Robots,” which revolved around the subject of science fiction, as he derived the word robot from the Czech word “robota,” which means forced labor. In the play, three robots were employed as slaves in a factory [10].

The American-Russian science fiction writer Isaac Asimov coined the term "robotics" and developed the three main rules for robotics. These rules serve as the foundation for South Korea's creation of the Robotics Code of Ethics, which aims to establish "ethical guidelines for the role and functions of robots" [8]

Human-like robots are difficult technologies to limit and define. Indeed, there is no the global scientific community has reached a consensus to establish a single, clear, specific, and precise definition for them, despite the development of numerous definitions.

The American Institute defined a smart robot, akin to a human, as a manual, multi-functional manipulator that can undergo reprogramming to execute various tasks. The design allows for the movement of parts, materials, tools, and special devices through a variety of programmed movements, enabling the completion of various tasks [11].

The International Organization for Standardization also defined smart robots in standard No. EN ISO 8373 as “robots that can perform specific tasks by sensing the surrounding environment or interacting with resources and external sources and adapting their behavior to them” [12].

The term "robot" refers to industrial machines or tools equipped with computers that mimic human behavior. From this perspective, It defined as mechanical tools that can perceive the external environment surrounding them, distinguish conditions, move based on them, and carry out tasks voluntarily and independently [13]. Also it defined as "an organic human being that can respond to external stimuli without the need for orders and control from humans" [14]. It defined as “built systems that display and simulate the mental and physical capabilities of humans without being biologically alive” [10].

To conclude, human-like robots are machines with external structures that resemble human appearance and are equipped with specific and advanced microprocessors that give these machines the ability to speak, act, respond, learn, acquire skills, make decisions, and perform most of the tasks that humans perform.

This section manipulates the impact of artificial intelligence on the development of robots in a way that enables them to make decisions.

2.1. Humanizing the robot from a legal and moral perspective

AI is known as a branch of modern computer science. It studies the development of computer programs and focuses on making machines capable of learning and making decisions until their skills become equivalent to humans' mental and intellectual skills [15].

The great and rapid scientific development, especially in AI, has affected human life in most aspects, particularly since its applications have become widespread around us in various fields and places. The most significant and contentious of these advancements are the smart robots, which have transformed the concept of a robot from a machine to a human-like entity capable of performing tasks, communicating, and developing cognitive skills such as making semi-independent decisions, learning from experiences, and displaying emotions and expressive reactions. [9], [16].

Expert systems, neural networks, fuzzy logic, natural language, and intelligent agents are the most significant AI systems used in the construction of human-like robots. These systems are explained in detail below:

They are programs designed for intelligent inferences and require specific human expertise to be accomplished. An expert system is a system that uses human knowledge stored in a computer to solve problems that usually require human expertise to solve, as it relies on analysis and deduction processes that experts use to solve specific problems they encounter. Expert systems include processors that receive inputs and then process them to arrive at meaningful information that helps make decisions [17].

To complete this, expert systems rely on a database that establishes their existence.

Expert systems are characterized by the fact that they do not reapply mathematical equations and algorithms again for similar or repeated problems but rather rely on previous experiences and problem analysis according to the methods they learned and were programmed to use [18].

Neural networks are considered one of the elements of AI. Scientists drew inspiration from anatomy and developed this idea to mimic the decision-making process of human brain neurons, represented by complex non-linear equations. These networks provide a cognitive model because they can learn from the information they process. It can analyze a large amount of data because it operates in parallel and interacts dynamically, simulating the complex environment of the human brain [19].

The significance of artificial neural networks lies in their ability to solve complex problems involving vast amounts of data beyond human analytical capabilities. They can adapt their structure based on the information they process. Therefore, neural networks depend on cognitive information systems distributed over many processors and on dynamic information systems that are built and programmed throughout development and training, because these systems learn from their experiences and acquire their knowledge and experiences through learning, training, and practical experience [20].

These systems were first developed by the Iranian scientist Lotfi Zadeh in 1965 at the University of California to achieve better data processing. In 1974, the application of fuzzy logic in numerous innovations and development projects, such as the steam engine and the production of fuzzy logic chips for various electronic products, brought attention to his theory [21].

Consequently, it depends on a perception model that mimics how the human mind estimates values using non-fuzzy data. It also investigates intermediate and ambiguous phenomena, focusing on the gray area between the two distinct colors of black and white [22]. One of the most important motives and goals for developing fuzzy logic is to give machines human skills in dealing with inaccurate data. However, this process was difficult and complex, leading to the emergence of expert systems or artificial intelligence [22]

An intelligent agent is an entity capable of perceiving its environment through its sensors and responding appropriately using its implementation mechanisms. Additionally, it possesses a knowledge database that it develops through learning, which it later utilizes to make independent decisions without external interference [23].

Computer vision systems, also known as intelligent vision systems, primarily use computer programs to distinguish and read handwritten texts. They also can produce images and search for desired images if they are identified and described accurately; its most important applications have been identified as segmenting images, classifying them, coloring them, and changing their patterns, resolution, and composition [21].

Understanding natural languages (human language) is considered one of the branches of AI. It branches out from informatics and overlaps with linguistics, which provides the linguistic description required for computers. This science focuses on building linguistic, morphological, semantic, grammatical, and phonetic wealth, enabling the creation of software capable of understanding and analyzing human language. It also aims to design an electronic encyclopedia of Arabic, meeting the demands of precise automated processing. It also aids in the development of accurate machine translation programs, considering the unique characteristics of the Arabic language [24].

Some refers to the following basic systems in natural language processing [25]:

a. Text-to-speech system: Converts natural language text into spoken speech.

b. Speech recognition system converts natural spoken language signals into a string of written words.

c. Machine translation system: Translates written text or spoken speech in one natural language into another.

d. Information retrieval system: searches for information stored in databases such as the Internet or the Web

Algorithms are the driving force and underlying framework of artificial intelligence; they serve as the central control mechanism that activates this otherwise dormant intelligence, enabling it to perform tasks [26]. They were named after the Arab scientist Jaafar bin Musa Al-Khwarizmi, the most prominent Arab scientist in mathematics and astronomy. An algorithm is a set of instructions structured as a sequence of specific commands that can be practically executed within computer systems. It serves as a fundamental guideline for reasoning and making decisions [27].

Some refer to the following elements and characteristics of the algorithm [28]:

a. Input: This is the data that the algorithm needs to process.

b. Outputs: The information that the algorithm will produce because of its work must include at least one value.

c. Clarity: The steps of the algorithm must be unambiguous.

d. Finiteness: This means that algorithm steps must be

solvable within a specific and limited period.

e. Solvability: All algorithm steps can be solved and are not impossible to solve.

The development of intelligent robots, integrating them into human daily life, and requiring close interaction with them—combined with their vast capabilities and data—raises concerns that they could potentially inflict significant harm to individuals and property or carry out malicious actions without specific limitations established. Therefore, manufacturers and developers of robots must adhere to principles and rules that restrict robots' freedom to act. The relationship of these robots, as AI technology, with the natural people in their surroundings should be regulated seriously and strictly [29].

The European Union has attempted to impose limitations on robot manufacture, ensuring that the robot remains subject to the human who made it or is associated with it, even if it receives an independent legal personality in the future. To do this, the Law Committee of the European Union submitted a proposal to regulate the ethical treatment of robotics engineers [30]. The proposal stipulated four basic principles included in the science of robotics engineering [31]:

a. Benevolence: the programming of robots to behave and serve humans in the best and most beneficial ways for them.

b. Justice: obligations and interests are distributed between the robot and other parties with complete transparency and fairness.

c. Non-harm: That is, robots should not be a means of harming humans at all.

d. Optional: society is free to choose whether to deal with robots or reject them, without dealing with them being coercive and obligatory.

However, many view these ethical principles as insufficient or lacking in rigor when it comes to effectively protecting humans from the harm that robots can cause. Consequently, civil, and criminal liability for actions and offenses committed by robots should continue to rest with the human representative who owns them [32].

Considering the civil liability of autonomous robots, the legal liability if the robot commits a harmful error is discussed. Establishing the legal status of robots involves addressing numerous questions about how these newcomers can be held civilly and criminally accountable for their actions. Results of research states that law acknowledges two distinct types of legal personalities: the natural person, conferred upon an individual based on their awareness and mental capacity, and the legal personality, granted to a person capable of acquiring rights and fulfilling obligations [33]. Robots are neither people nor things; however, they are between the two personalities, and some even call them the "electronic person" [34]. In the jurists' discussion about the legal nature of these robots, it was necessary to compare them with things and people as follows:

According to jurisprudence, there are several conditions for acquiring the quality of a thing: it must be of a material nature that is living but non-rational, such as animals, or non-living, such as inanimate objects. If we examine these characteristics in smart robots, we discover that they are unique and embody the essence of human creativity. These robots consist of a collection of AI programs that control a variety of peripheral electronic devices. They can act and make decisions without referring to their maker or human guardian [35]. Products are described as all movable items, whether tangible or intangible. Smart robots, while a physical manifestation of human intellectual creations, can produce, create, and deliver services. Consequently, their moral identity should not be considered a product [36].

The regulation of smart robots, under guarding laws, is a contentious issue among legal scholars. Some advocate for acknowledging their legal personality and propose the concept of a digital guardian for these robots, which is embodied in the intelligence engine that issues commands and decisions to their physical forms. This engine operates independently, allowing it to select the most suitable option from a range of alternatives generated by specialized algorithms. Additionally, it is equipped to adapt to new situations through inferential processes. The other jurisprudential trend believes that the digital guardian of smart robots must have awareness, which robots do not have, and therefore they cannot be considered their digital guardian [37].

This prompted jurists to develop traditional rules in civil law to find a solution to the problem of determining the person responsible for the actions of smart robots. As a result, the theory of the "responsible human representative" emerged, which the European Union adopted.

This theory was developed to determine who is responsible for the harmful actions they cause. It was developed by the European legislator with the knowledge of the Union's Legal Committee and under the rules of the European Civil Code on Robotics 2017. It assumes the existence of a legal representation of responsibility for operating errors between smart robots and their manufacturer or programmer so that the human being is responsible for these errors [38].

This delegation of responsibility is relevant in certain instances, particularly in establishing the necessary elements of liability, which include error, damage, and causal connection throughout various stages, such as manufacturing, operating, or utilizing smart robots. This is referred to as full responsibility, which arises from a human agent's failure to fulfill their duty to prevent harmful and damaging incidents caused by negligence or inaction during the programming of these robots [39].

As for this responsible human representative, he may be the owner of the factory in which the smart robots are made, the engineer responsible for manufacturing defects or operating defects, or negligence in maintenance by the manufacturer, or the operator that exploits these robots, or the owner, who is the person who bought this robot is for his service others' services and the responsible user of the behavior of this robot if it doesn't harm any of the people or things around it.

The following several responsibilities of the deputy [40]:

a. Tort liability: He bears responsibility for all damages

caused by smart robots after the elements of this responsibility are met.

b. Contractual liability: It results from damages caused to the customers of the operating and owner company due to smart robots following the general rules of liability.

c. Criminal liability: This refers to accountability for crimes carried out by robots under the instructions and orders of their human representative, particularly when the representative directs and utilizes these robots to engage in specific criminal activities.

The researcher argues that the theory of accountability for the human representative is among the most effective and rational theories in this field, as it discourages manufacturers and users of smart robots from directing or programming these robots in harmful ways. Furthermore, the researcher emphasizes the necessity of implementing stricter penalties on human representatives for any harm caused by these robots, given that the potential danger posed by smart robots globally is more significant and serious than we may realize.

Both Western and Arab jurisprudence were unable to establish criminal liability for smart robots except after relying on general criminal law rules, such as the theory of the moral actor; the European Union also approved the theory of the "responsible human representative," which means transferring criminal responsibility committed by robots to the responsible human representative under certain conditions [41]. However, the jurisprudential trends remain different regarding holding robots criminally responsible for the crimes they may commit, as [42] pinpoints the following opinions:

Proponents of this view argue that robots embody both the material and moral foundations of a crime. They achieve the material (realistic) pillar because they carry out their actions through the various mechanical mechanisms of which they are composed. Therefore, everything that is done through these mechanisms can be considered the desired action of the crime, as the robot works intelligently thanks to the systems that guide it and move its electrical or hydraulic components, which justifies saying that the actions of these robots, especially those that are independent of human intervention, meet the requirements of the physical act, which represents one of the elements of the crime [43].

If a robot collides with a person nearby, this incident can be viewed as a criminal act, particularly in the context of assault laws. In this regard, the electrical or hydraulic motion of the robot is regarded as the physical action that constitutes the crime [44].

While some oppose this opinion on the basis that the material element of the crime includes the criminal behavior, the harm, and the causal relationship between them, so the assessment remains ambiguous about who issued the order to carry out this criminal act, as it cannot be accepted that the act was entirely borne out of the will of the robot rather than it being the result of the information, equations, and commands that the engineer who programmed and manufactured it programmed it with. This negates the possibility of considering robot movements as a basis for the physical element of the crime [45].

Regarding the moral element of a crime, advocates of this perspective argue that robotic devices fulfill the moral (psychological) component of criminality. Their stance is based on the principle that robots have cognitive abilities enhanced by modern technology. They contend that since robots possess knowledge—which can continually evolve—the conditions for establishing criminal liability are met [46].

This is the trend supported by most legislation around the world, as they believe that we cannot hold criminally responsible any person unless he is free in his will and actions and therefore has full legal capacity, which is limited to natural persons only and cannot be attributed to robots in any way [47].

As indicated by researchers proponents of this perspective support their viewpoint with two main arguments [48]:

a. Attribution of Crimes to Robots: It is challenging to assign crimes to robots. The foundation of criminal responsibility lies in attributing the crime to its perpetrator. This attribution relies on the personal characteristics and inherent qualities of the perpetrator, necessitating that they possess the appropriate qualifications for the attribution to be valid. These qualifications include psychological and mental capabilities that enable the individual to comprehend the nature and consequences of their criminal actions [34].

b. Psychological Competence as an Alternative: Some individuals have suggested using the notion of psychological competence for punishment as a substitute for the concept of attribution. This idea emphasizes the existence of a psychological motive or rationale behind the individual's criminal actions, thereby establishing a psychological connection between the offender and their crime [41].

There is a distinction between the philosophy of criminal punishment and the concept of criminal responsibility for robots. The philosophy of criminal punishment views penalties or punishments as measures enforced by criminal law for psychological, moral, and behavioral objectives, including deterrence, awareness, reform, reprimand, and both general and specific deterrence [47]. Consequently, the primary role of criminal punishment is to fulfill a certain philosophical framework, which may vary in its application but ultimately shares the same overarching context. However, this perspective does not consider that the subject of such punishment may be an intelligent industrial robot [49].

This is the trend supported by most legislation around the world, as they believe that we cannot hold criminally responsible any person unless he is free in his will and actions and therefore has full legal capacity, which is limited to natural persons only and cannot be attributed to robots in any way [47].

As indicated by researchers proponents of this perspective support their viewpoint with two main arguments [48]:

a. Attribution of Crimes to Robots: It is challenging to assign crimes to robots. The foundation of criminal

responsibility lies in attributing the crime to its perpetrator. This attribution relies on the personal characteristics and inherent qualities of the perpetrator, necessitating that they possess the appropriate qualifications for the attribution to be valid [49]. These qualifications include psychological and mental capabilities that enable the individual to comprehend the nature and consequences of their criminal actions.

b. Psychological Competence as an Alternative: Some individuals have suggested using the notion of psychological competence for punishment as a substitute for the concept of attribution. This idea emphasizes the existence of a psychological motive or rationale behind the individual's criminal actions, thereby establishing a psychological connection between the offender and their crime [49].

There is a distinction between the philosophy of criminal punishment and the concept of criminal responsibility for robots. The philosophy of criminal punishment views penalties or punishments as measures enforced by criminal law for psychological, moral, and behavioral objectives, including deterrence, awareness, reform, reprimand, and both general and specific deterrence. Consequently, the primary role of criminal punishment is to fulfill a certain philosophical framework, which may vary in its application but ultimately shares the same overarching context. However, this perspective does not consider that the subject of such punishment may be an intelligent industrial robot.

The EU's Robotics Code of Ethics and Japan's guidelines emphasize the need for a global approach to robotics and AI ethics. Accountability, transparency, and autonomous system morality are addressed by these paradigms [50]. The EU's policy stresses human control and legal restrictions for robots, whereas Japan's ideals promote harmony between humans and robots to suit social requirements [48]. Both initiatives demonstrate a growing awareness that clear norms are needed to reduce legal issues associated with autonomous robots [51]. This worldwide debate promotes national collaboration and agrees on norms for responsible AI technology development and implementation [48].

The modern world has faced many issues resulting from the intervention of robots in human life as an assistant in many professions or as a substitute in some of them, including [52]:

This vehicle was involved in a traffic accident that led to the death of engineer Walter Huang, an employee at Apple. Investigations revealed that the car failed to provide timely alerts to the victim, with its last warning being issued 15 minutes before the incident [53].

The issue of military robots in South Africa

This robot was programmed to confront enemy aircraft only; it mistakenly shot and killed South African soldiers without warning, causing the death of 9 soldiers and wounding 14 others during training [54].

The case of the da Vinci surgeon robot

In 2005, at Bryn Mawr Hospital in Philadelphia, a patient underwent a prostatectomy performed by a surgical team that included several doctors and the Da Vinci surgical robot. During the procedure, the robot began to show error messages and prevented the human doctors from resetting its arm. Consequently, the team had to disassemble the robot after 45 minutes of attempting to fix the issue. This malfunction resulted in adverse complications for the patient, leading to a lawsuit against both the hospital and the manufacturer of the robot, Da Vinci [55].

In 2018, a Boeing 737 Max, operated by a new crew and carrying 181 passengers, took off from Jakarta. Shortly after departure, the aircraft's systems issued warnings that went unheeded by the crew. Meanwhile, the plane's automated self-control system made an abrupt decision to descend, anticipating that the pilots would regain control. This resulted in the aircraft crashing into the Java Sea. Similarly, in 2019, another plane of the same model took off from Addis Ababa and crashed due to a malfunction in its sensor [56]. Considering the great invasion of robots into all aspects of human life, jurisprudence has attempted to establish ethical and legal frameworks that govern the robot as an independent entity with an independent legal personality and to be subjected to these legal frameworks as indicated [57]:

a. Robots should not be programmed by their developers and manufacturers to engage in activities that contravene the law.

b. There should be restrictions on the self-development of intelligent robots to prevent them from exhibiting harmful, aggressive, or unilateral behavior that violates legal standards.

c. The deep learning capabilities of artificial intelligence robots and technologies must align with human instructions and intentions, ensuring that these technologies remain under human control and do not evolve into uncontrollable adversaries.

The interest of international law in this matter has increased after the emergence of autonomous killer robots, which can kill and engage a human target without external interference. Their weapons and combat capabilities exceed the capabilities of ordinary humans, which makes them a deadly killer that poses a great danger to humanity [58]. Therefore, the United Nations General Assembly, at the twenty-third session, spoke about these robots and their great danger and issued some recommendations in this regard and focused on calling on all countries to declare an optional national position regarding the testing, producing, possessing, and using of deadly autonomous robots [59].

Until an international agreement is reached on the future of these robots, Japan has set ten principles that govern the work of robots [60]:

a. Robots must work to serve humanity.

b. Robots must not kill or injure humans.

c. Robot makers must be responsible for their creations.

d. Robots must be involved in the production of contraband, currencies, or dangerous goods and must hold a valid permit.

e. Robots may not leave the country without a permit.

f. Robots' identity must not be changed, hidden, or allowed

to be misunderstood.

g. Robots must always remain renewable.

h. Robots created for adult purposes are not allowed to work with children.

i. Robots must not assist in criminal activities, nor aid or incite criminals to evade justice.

j. Robots must not damage homes or human tools, including other robots.

South Korea approved the Code of Ethics for Robotics, which included the following rules [61]:

First, regarding the manufacturing standards, robot manufacturers must:

a. Ensure that the robots they design have limited autonomy and can be controlled by humans if necessary.

b. Establish strict quality control standards and implement all possible and reasonable measures to minimize the risk of death or injury to users and to ensure the safety of the community."

c. Take serious steps to reduce the risks of psychological harm to users, which includes the possibility that the robot may encourage aggressive and harmful behaviors that lead to social dysfunction and morbidity, such as depression, stress, addiction, anxiety, and others.

d. Ensure that their products are identifiable, and that this identification is protected from change.

e. Design robots to protect personal data through encryption and secure storage.

f. Design robots so that they can be monitored, and their actions always tracked in the real world and online.

g. Design robots that are environmentally sensitive and sustainable.

Second, as for the rights of users/owners, they have the following rights:

a. Be able to control their robot.

b. Use their robots without risk or fear of psychological or physical harm.

c. Protect their data and other sensitive information.

d. Expect their robots to perform any task for which they were explicitly designed.

Third, owners and users are held to the following responsibilities:

a. The user has the right to use the robot in any way he deems appropriate, as long as this use is legal and fair within the standards of the law.

b. The user must not use the robot to commit illegal acts.

c. The user must not use his robot in a way that could be interpreted as causing psychological or physical harm to others.

d. The owner must take all possible and reasonable precautions to ensure that his or her robot does not pose a threat to the safety and property of others.

e. The following acts are considered a crime under Korean law: intentionally damaging or destroying a robot through gross negligence, allowing the robot to cause harm; Intentionally dealing with a robot in an abusive manner is considered a less serious crime, but it is nonetheless dangerous.

Fourth, robots' responsibilities are as follows [61]:

a. A robot may not harm a human being or allow them to hurt others through inaction.

b. The robot must obey any orders issued to it by humans, except in cases where these orders conflict with what is stated in this charter.

c. A robot must not deceive a human being.

Fifth, robots under Korean law are granted a set of basic rights, such as the right to exist without fear of injury or death and the right to live a life free from systematic abuse.

In legal terms, an individual must possess a recognized legal personality to acquire rights. People are categorized into two groups: natural persons, who refer to human beings capable of holding rights and fulfilling obligations, and legal persons, which include entities such as companies, associations, and similar organizations with independent legal status [62]. Therefore, to grant robots legal rights, these robots must initially have a recognized legal personality. On this point, jurisprudential opinions differed and emerged in two trends.

8.1 Jurisprudential trend supporting the idea of providing robots with personality and legal rights.

This trend stems from the fact that the robot can be viewed as a legal entity, entitled to legal personality, and thus to be granted legal rights just like companies, bodies, and others [63]. , The proponents of this trend offer some justifications for their opinion, embodied in the following points [64]:

a. Robots are not subject to any judicial authority, despite the great development that has affected them, which has enabled them to carry out harmful, dangerous, and law-breaking actions on their own.

b. AI systems could learn and create independently. Therefore, it is necessary to identify a person or entity that reaps the benefits of intellectual property rights concerning the inventions and innovations that artificial intelligence generates.

c. Robots cannot be considered natural persons since their continuous rapid development, which makes their intelligence comparable to or even superior to human intelligence, may prompt and encourage them to be considered natural persons entitled to full legal personality. For example, the robot "Sofia" is a chat robot with a human face and was granted KSA citizenship in 2017.

d. There are concerns and fears that robots and artificial intelligence systems may engage in criminal activities and unlawful acts. This necessitates the development of a legal framework that allows for their neutralization, cessation, and control to prevent a scenario where they deem humans unnecessary and seek to eliminate them.

Consequently, granting robots legal personality is significant as it serves as a foundational aspect in establishing

their accountability for any material damages they may cause [65].

This was supported and confirmed by the European Parliament in its resolution issued in 2017, which stipulated granting legal personality to all advanced robots that have the ability to analyze, deduce, and make decisions and which can deal with others on their own and with complete independence [66].

Along with registering these robots in official records that include identifying information and detailed descriptions, an insurance system should be established to mitigate risks associated with them. This approach would hold the robots accountable for their actions and the resulting damages, rather than placing this responsibility on the robot's manufacturer or owner [67].

The researcher argues that granting personal robots' legal status and holding them accountable for their actions is challenging [61], [65]. This should be accompanied by stringent controls and penalties for the developers of these robots, ensuring that they create machines devoid of violent and harmful concepts. Even in cases of less severe damage, the responsibility ultimately lies with the individuals who conceived and developed these robots. A pertinent example is the S.U.V. Klein incident, where one of the pilots activated the autopilot feature to enable automatic landing, despite various circumstances.

Warnings against using this option the landing was improper and caused serious damage to the plane, and here the responsibility was not placed on the autopilot; however, on the pilot who made the autopilot perform the landing [68].

Thus, the researcher supports the other opinion opposing granting robots a legal personality, which was tackled in detail.

Proponents of this opinion believe that granting legal personality is a matter related to acquiring rights and performing legal duties, a matter in which robots have not yet been proven competent, but it is clear and conclusive that robots are unable to bear legal responsibility for the damages they may cause at all, in addition to the point that robots, even those capable of making decisions, are unable to exercise discretionary authority that changes according to the circumstances surrounding a particular issue [69].

Individuals who support this viewpoint assert that only humans (natural persons) should be granted legal rights, as they possess unique personal attributes that legal persons and robots lack, including emotions, consciousness, intent, beliefs, and morality [9].

Also, humans can interpret and understand legal rules and texts and adhere to them through daily life situations and through their social relationships with others, which is something that robots cannot do. As a result, there are no real and logical justifications for granting robots legal personality, property rights, or the right to conclude contracts or perform taxes. Therefore, it must be treated as a product, even in the context of responsibility for the damages it causes, and therefore the rules of liability that relate to product defects only apply to it, which is what the researcher fully supports [70].

The challenges of implementing human-like robot legislation:

This section reviews the legal and legislative challenges that may occur while applying this legislation.

From the discussion above, it is evident that there is an urgent need to establish strict legislation and laws governing smart robots from the time of their manufacture until they are in the hands of the end-user and during their possession. However, we can identify several challenges and obstacles that may impede the development of serious and cohesive global legislation.

The following three basic challenges of AI regulation [71]:

a. Legal scholars have yet to reach a consensus on the legal status of smart robots. Until their legal nature is clearly defined, it is challenging to create specific legislation for them or to protect them from any liability.

b. Legislation pertaining to smart robots should encompass human, ethical, scientific, and technological dimensions. These aspects necessitate comprehensive and prolonged research, particularly given that smart robots are advancing their capabilities at a pace that surpasses human comprehension [72].

c. The legislation established for robots should primarily target their manufacturers, programmers, and users, mandating restrictions on the capabilities of these robots to reduce their potential for harm. However, the challenge lies in enacting and enforcing these regulations, as manufacturers continue to introduce new advancements and features for their intelligent robots daily [73].

II. RESULTS

The rapid advancements in smart robotics have enabled these machines to increasingly participate in various aspects of human life, performing tasks with growing autonomy and decision-making capabilities. This technological leap has necessitated urgent legal considerations to address the implications of robots' integration into society. Key issues include the lack of consensus among legal scholars regarding the grant of legal personality to robots, the increased liability for developers and operators due to robots' autonomous functioning, and the potential for harm caused by unforeseen events. The European Civil Code's introduction of the "responsible human representative" theory in 2017 underscores the need for a legal framework assigning accountability to human operators for robot actions. Despite their advanced capabilities, robots still fall short of humans in situational assessment and decision-making, highlighting the ongoing challenge of appropriately legislating their roles and responsibilities in human society [74].

The great development that has occurred in smart robots, which has qualified them to enter all aspects of human life, and

even to act and make decisions independently, has created a serious and urgent legal need to develop special legislation for them that recognizes their eligibility on the one hand, and sets specific and strict rules and restrictions for them in a way that prevents the possibility Cause harm to individuals and surrounding property.

Legal scholars have not yet agreed on a unified opinion regarding granting robots legal personality, which is essentially based on possessing mental and legal capacity and the ability to acquire rights and assume obligations and duties.

AI or robots are programmed to pursue assigned tasks and objectives autonomously and are therefore unable to pursue and respond to unexpected situations that lead to unwanted or illicit outcomes. Therefore, developers, operators, and users of AI may be held liable for negligence or unskillfulness.

One of the best theories that have been developed in this field is the theory of the "responsible human representative," which was introduced by the European Civil Code in 2017 and made the person responsible for the robot, whether a manufacturer, operator, owner, or user, directly responsible for any damages or harm that this robot may cause. Android. Whatever their capabilities and intelligence, robots cannot yet match humans in assessing situations and making the best decision based on the circumstances [75].

III. CONCLUSION

If your paper is intended for a conference, please contact your conference editor concerning acceptable word processor formats for your particular conference.

The dynamic progress in the field of smart robotics presents both promising opportunities and formidable challenges. While robots are becoming increasingly integrated into diverse aspects of human life, this integration underscores the urgent necessity for comprehensive and specialized legal frameworks. These frameworks must address issues such as the potential recognition of legal personality for robots, the stringent liability of developers and users for autonomous robot actions, and the critical need for responsible human oversight as encapsulated by the "responsible human representative" theory. Until robots can reliably match human judgment and decision-making skills in a wide range of complex situations, it will be very important to keep an eye on things and make sure that laws are updated as needed to protect society from possible dangers and make sure that robotic technologies are used in an ethical and safe way.

Suggestions

The following are suggestions for further research:

1. Establishing serious and strict legislation for smart robots and organizing robots into registers containing their basic information.

2. Relying on the ten principles identified by Japan, which restrict the methods and objectives of making robots, as well as restricting their transfer and areas of use, to be a basis for organizing unified global legislation related to robots.

3. Governments should implement strong regulatory frameworks that ensure robots are designed, manufactured, and used safely and ethically.

4. Establishing mechanisms for periodic monitoring and evaluation of the effectiveness of laws and legal procedures related to robotics and national security to ensure that they are constantly updated and developed in line with technological developments.

ACKNOWLEDGMENT

The researchers team Acknowledge the Scientific Research Deanship at the University of Ha'il- Saudi Arabia.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work the authors used Quill Bot/ English Paraphraser in order to improve language, rephrase and reduce word count. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

References

[1] D. Nersessian and R. Mancha, "From automation to autonomy: legal and ethical responsibility gaps in artificial intelligence innovation," *Mich. Tech. L. Rev.*, vol. 27, p. 55, 2020. Available at: https://heinonline.org/HOL/LandingPage?handle=hein.journals/mttlr27&div=6&id=&page=. Accessed on October 10, 2024.

[2] Z. Li and W. Zhang, "Technology in education: Addressing legal and governance challenges in the digital era," *Education and Information Technologies*, pp. 1–31, 2024. https://doi.org/10.1109/WTS48268.2020.9198734.

[3] C. Cath, S. Wachter, B. Mittelstadt, M. Taddeo, and L. Floridi, "Artificial intelligence and the 'good society': the US, EU, and UK approach," *Science and Engineering Ethics*, vol. 24, 2018, pp. 505–528. https://doi.org/10.1007/s11948-017-9901-7.

[4] J. P. Boada, B. R. Maestre, and C. T. Genís, "The ethical issues of social assistive robotics: A critical literature review," *Technology in Society*, vol. 67, 2021, p. 101726. https://doi.org/10.1016/j.techsoc.2021.101726.

[5] Li, Z., Zhang, W. Technology in education: Addressing legal and governance challenges in the digital era. *Educ Inf Technol* (2024). https://doi.org/10.1007/s10639-024-13036-9.

[6] M. Soori, B. Arezoo, and R. Dastres, "Artificial intelligence, machine learning and deep learning in advanced robotics: a review," *Cognitive Robotics*, vol. 3, pp. 54–70, 2023. https://doi.org/10.1016/j.cogr.2023.04.001.

[7] S. A. Salama, *Robot Technology: A Future Vision through Arab Eyes*, Academic Library, 2006.

[8] L. Chengyun, "A study on the recommendation method of intelligent media learning resources in the foreign communication and teaching of international communication of Chinese Central Plains culture," *International Journal of Education and Information Technologies*, vol. 17, 2023, pp. 51–58.

[9] A. S. A. Al-Borai, "Applications of artificial intelligence and robotics from the perspective of Islamic jurisprudence," *Egyptian Dar Al-Iftaa Magazine*, Issue Forty-Eight, Egypt, 2022.

[10] U. M. Ibrahem, A. A. Saleh, and A. B. ALharby, "The effectiveness of the interaction of interactive book cues and levels of information processing on learning retention and external cognitive load," *International Journal of Education and Information Technologies*, vol. 2021. https://doi.org/10.46300/9109.2021.15.7.

[11] N. M. Richards and W. D. Smart, "How Should the Law Think About Robots?," *SSRN Electronic Journal*, 2013.

[12] Perez JA, Deligianni F, Ravi D, Yang GZ. Artificial intelligence and robotics. arXiv preprint arXiv:1803.10813. 2018 Mar;147:2-44. .

[13] T. Logsdon, *The Robot Revolution*, New York: Simon & Schuster, 1984.

[14] ISO 8373: 2012 (en), *Robots and Robotic Devices - Vocabulary: "Intelligent Robot"*.

[15] J. P. Albrecht, J. Reda, and M. Andersson, "Position on robotics and artificial intelligence/Green Working Group Robotics," 2016.

[16] R. Calo, "Open robotics," *Maryland Law Review*, vol. 70, no. 3, 2011, pp. 77–81.

[17] P agallo, U. When Morals Ain't Enough: Robots, Ethics, and the Rules of the Law. *Minds & Machines* 27, 625–638 (2017). https://doi.org/10.1007/s11023-017-9418-5.

[18] A. Mohammed, R. Ali, and A. Abdullah, "The Reality of Using Artificial Intelligence Techniques in Teacher Preparation Programs in Light of the Opinions of Faculty Members: A Case Study in Saudi Qassim University," *Multicultural Education*, 7(1), pp. 5–16, 2021. https://doi.org/10.5281/zenodo.4410582.

[19] A. T. B. Mohamed, "Using intelligent robots equipped with artificial intelligence technologies in the judicial system," *Journal of Legal and Economic Studies*, vol. 14, no. 0, pp. 787–835, 2024. https://doi.org/10.21608/MJLE.2024.386592.

[20] U Ibrahem, U. M., Abdelfatah, H. M., Kedwany, D. M., AlMankory, A. Z., Diab, I. M., & Abdul Kader, R. A. (2023). The Drivers of Change for Future Learning: How Teachers Were Taught in the COVID-19 Crisis and What Will Come Next?. Sustainability, 15(20), 14766. https://doi.org/10.3390/su152014766 .

[21] R. Kader, P. Bassett, Y. Kabir, S. Cheung, L. G. Macabodbod, A. Jayanthi, M. Chand, and L. Lovat, "Randomized Controlled Trial of a Cloud-Based Artificial Intelligence (AI) Computer-Aided Diagnosis (CADx) System in Non-Expert Endoscopists," *Gastrointestinal Endoscopy*, vol. 99, no. 6, pp. AB12–AB13, 2024. https://doi.org/0.1055/s-0044-1782805.

[22] S. Akgun and C. Greenhow, "Artificial intelligence in education: Addressing ethical challenges in K-12 settings," *AI and Ethics*, vol. 2, no. 3, pp. 431–440, 2022. https://doi.org/10.1007/s43681-021-00096-7.

[23] R. Satheeskumar, "Enhancing Drug Discovery with AI: Predictive Modeling of Pharmacokinetics Using Graph Neural Networks and Ensemble Learning," *Intelligent Pharmacy*, 2024. https://doi.org/10.1016/j.ipha.2024.11.002.

[24] W. Ullah, A. Ullah, T. Hussain, K. Muhammad, A. A. Heidari, J. Del Ser, S. W. Baik, and V. H. C. De Albuquerque, "Artificial Intelligence of Things-assisted two-stream neural network for anomaly detection in surveillance Big Video Data," *Future Generation Computer Systems*, vol. 129, pp. 286–297, 2022. https://doi.org/10.1016/j.future.2021.10.033.

[25] H. S. J. Ismail, "Artificial Intelligence: Its Educational Applications and Dangers: (Analytical Study)," *Zagazig Faculty of Technology and Development Journal*, vol. 33, no. 33, pp. 280–377, 2023.

[26] A. Moulay, "Application of Artificial Intelligence and Emotional Intelligence in Decision Making," *Knowledge Collections Journal*, vol. 3, no. 4, pp. 187–205, 2021. https://doi.org/10.21608/cfdj.2025.345417.2125.

[27] P. Koehn, *Intelligent Agents*, 2020.

[28] H. S. J. Ismail, "Artificial Intelligence: Its Educational Applications and Dangers: (Analytical Study)," *Zagazig Faculty of Technology and Development Journal*, vol. 33, no. 33, pp. 280–377, 2023.

[29] A.Q. Sam (2022). The effectiveness of artificial intelligence applications in teaching the Arabic language electronically, *Linguistics and Translation, 12*(8), 354-405.b https://ssrn.com/abstract=4565768.

[30] J. Dorn, "Web information retrieval and search," in *Springer eBooks*, 2022, pp. 253–272. https://doi.org/10.1007/978-3-030-05324-6_16-1.

[31] G. Al-Omran, S. Al-Abdulhadi, and M. R. Jan, "Ethics in artificial intelligence," in *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 2019.

[32] V. C. Müller, *Philosophy and Theory of Artificial Intelligence 2021,* in *Studies in Applied Philosophy, Epistemology and Rational Ethics*, 2022. https://doi.org/10.1007/978-3-319-96448-5.

[33] O. A. Osoba, W. Welser IV, and RAND Corporation, "Perspective," in *RAND Corporation*, 2017.

[34] V. C. Müller, *Philosophy and Theory of Artificial Intelligence 2021,* in *Studies in Applied Philosophy, Epistemology and Rational Ethics*, 2022. https://doi.org/10.1007/978-3-319-96448-5.

[35] F. Sanfilippo, M. H. Zafar, T. Wiley, and F. Zambetta, "From caged robots to high-fives in robotics: Exploring the paradigm shift from human–robot interaction to human–robot teaming in human–machine interfaces,"

Journal of Manufacturing Systems, vol. 78, pp. 1–25, 2024. https://doi.org/10.1016/j.jmsy.2024.10.015.

[36] T. C. Callari, R. V. Segate, E. Hubbard, A. Daly, and N. Lohse, "An ethical framework for human-robot collaboration for the future people-centric manufacturing: A collaborative endeavour with European subject-matter experts in ethics," *Technology in Society*, vol. 78, 2024, p. 102680. https://doi.org/10.1016/j.techsoc.2024.102680.

[37] Ostrowski AK, Walker R, Das M, Yang M, Breazea C, Park HW, Verma A. Ethics, equity, & justice in human-robot interaction: A review and future directions. In2022 31st IEEE International Conference on Robot and Human Interactive Communication (RO-MAN) 2022 Aug 29 (pp. 969-976). IEEE. doi: 10.1109/RO-MAN53752.2022.9900805.

[38] D. Neumann, *Human Assistant Robotics in Japan*, 2016.

[39] S. Desmoulin-Canselier, "Les intelligences non humaines et le droit: Observations à partir de l'intelligence animale et de l'intelligence artificielle," *Archives de philosophie du droit. Le droit et les sciences de l'esprit*, vol. 55, 2012, pp. 65–87.

[40] A. Kim, N. Barnes, C. Bailey, A. Krieger, and C. R. Weiss, "Remote-Controlled and Teleoperated Systems: Taking Robotic Image Guided Interventions to the Next Stage," *Techniques in Vascular and Interventional Radiology*, p. 101008, 2024. https://doi.org/10.1016/j.tvir.2024.101008.

[41] C. Castelfranchi and R. Falcone, "From automaticity to autonomy: The frontier of artificial agents," in *Multiagent Systems, Artificial Societies, and Simulated Organizations*, 2003, pp. 103–136.

[42] H. Almelweth, "The effectiveness of a proposed strategy for teaching geography through artificial intelligence applications in developing secondary school students' higher-order thinking skills and achievement," *Pegem Journal of Education and Instruction*, vol. 12, no. 3, 2022. https://doi.org/10.47750/pegegog.12.03.18.

[43] V. Thibault and W. Etienne, "La Responsabilité des Fournisseurs d'Outils de Recherche et D'Hyperliens du Fait du Contenu des Sites Référencés," *Droit et Nouvelles Technologies*, vol. 181, pp. 272–314, 2001.

[44] B. You, X. Chen, J. Li, L. Ding, and Z. Dong, "Human-robot Collaborative Decision Method of Hexapod Robot Based on Prior Knowledge and Negotiation Strategy," *Knowledge-Based Systems*, p. 112551, 2024. https://doi.org/10.1016/j.knosys.2024.112551.

[45] M. S. Akhoirshieda, K. M. N. K. Khalif, and S. Awang, "Artificial intelligence in the United Arab Emirates public sector: a systematic literature review," *IAES International Journal of Artificial Intelligence*, vol. 13, no. 3, 2024, p. 2472. https://doi.org/10.11591/ijai.v13.i3.pp2472-2481.

[46] A. Nanos, "Criminal liability of artificial intelligence," *SSRN Electronic Journal*, 2023.

[47] Hifajatali, S. "Artificial intelligence and criminal liability in India: exploring legal implications and challenges." *Cogent Social Sciences* 10.1 (2024): 2343195. http://dx.doi.org/10.2139/ssrn.4623126.

[48] G. Hallevy, "The criminal liability of artificial intelligence entities: From science fiction to legal social control," *Akron Intellectual Property Journal*, vol. 4, no. 2, 2010, Article 1. https://doi.org/10.1080/23311886.2024.2343195.

[49] I. Begishev, "Criminal-legal protection of robotics: notion and content," *International Journal of Law in Changing World*, vol. 1, no. 2, 2022, pp. 73–83.

[50] A. Ali, "Artificial intelligence and criminal liability: challenges in articulation of legal aspects for counter-productive actions of machine learning," *International Journal of Instructional Technology and Educational Studies*, vol. 2, no. 3, 2021, pp. 13–20. https://doi.org/10.21608/IHITES.2021.90657.1049.

[51] P. Majumdar, B. Ronald, and R. Rautdesai, "Determination of Criminal Liability," *Journal of Critical Reviews*, vol. 6, no. 6, pp. 323–325, 2019. http://dx.doi.org/10.22159/jcr.06.06.48.

[52] P. Čerka, J. Grigienė, and G. Sirbikytė, "Is it possible to grant legal personality to artificial intelligence software systems?" *Computer Law & Security Review*, vol. 33, no. 5, 2017, pp. 685–699. https://doi.org/10.1016/j.clsr.2017.03.022.

[53] J. Tharwat, *The General Theory of the Penal Code*, University Cultural Foundation, 1998.

[54] M. Suef, Artificial Intelligence Crimes: The New Criminals", New University House, Egypt, 2022.

[55] A.K, Abdullah, & M. Al-Zangana, "Criminal Liability for the Use of Robotic Devices - A Comparative Study". Al-Farabi Journal for Humanity sciences, 2(2), 2023, pp. 1-21.

[56] M. Hironori, and G. Lindemann. "The autonomy-safety-paradox of service robotics in Europe and Japan: a comparative analysis." *AI & society* 31. pp. 2016, 501-517. https://doi.org/10.1007/s00146-015-0630-7.

[57] P. Majumdar, B. Ronald, and R. Rautdesai, "Determination of Criminal Liability," *Journal of Critical Reviews*, vol. 6, no. 6, pp. 323–325, 2019.

[58] O. Kovacs, "Inclusive industry 4.0 in Europe—Japanese lessons on socially responsible industry 4.0," *Social Sciences*, vol. 11, no. 1, 2022, p. 29. https://doi.org/10.3390/socsci11010029.

[59] Y. Wang and S. Haytham. "SHIFTing artificial intelligence to be responsible in healthcare: A systematic review." Social Science & Medicine 296, 2022, 114782. https://doi.org/10.1016/j.socscimed.2022.114782.

[60] P. Salvini, L. Kunze, and M. Jirotka, "On self-driving cars and its (broken?) promises. A case study analysis of the German Act on Autonomous Driving," *Technology in Society*, vol. 78, p. 102628, 2024. https://doi.org/10.1016/j.techsoc.2024.102628.

[61] E. Mbunge, I. Chitungo & T. Dzinamarira, "Unbundling the significance of cognitive robots and

drones deployed to tackle COVID-19 pandemic: A rapid review to unpack emerging opportunities to improve healthcare in sub-Saharan Africa". *Cognitive Robotics,* 1, 2021, 205–213. https://doi.org/10.1016/j.cogr.2021.11.001.

[62] B. Rocco, S. Assumma, T. Calcagnile, M. Sangalli, F. Turri, P. Dell'Orto, L. Sarchi, A. Grasso, I. Piacenitni, and M. Sighinolfi, "A synoptic journey in robotic assisted radical prostatectomy with three different platforms: Clinical cases by a single surgeon with the Da Vinci, HugoTMRAS and Versius surgical systems," *European Urology*, vol. 83, p. S1997, 2023.

[63] S. Ballingall, M. Sarvi, and P. Sweatman, "Safety assurance for automated systems in transport: A collective case study of real-world fatal crashes," *Journal of Safety Research*, vol. 92, 2024, pp. 27–39. https://doi.org/10.1016/j.jsr.2024.11.008.

[64]] J. Doomen, "The artificial intelligence entity as a legal person," *Information & Communications Technology Law*, vol. 32, no. 3, 2023, pp. 277–287. https://doi.org/10.1080/13600834.2023.2196827.

[65] S. Shakuntla. "Legal Personality for Artificial Intelligence with Special Reference to Robot: A Critical Appraisal," *Indian Journal of Law and Human Behavior*, vol. 6, no. 1, pp. 15–22, 2020.

[66] F. Yakub, A. Z. M. Khudzari, and Y. Mori, "Recent trends for practical rehabilitation robotics, current challenges and the future," *International Journal of Rehabilitation Research*, vol. 37, no. 1, pp. 9–21, 2014. https://doi.org/10.1097/MRR.0000000000000035.

[67] A. Jalahussein, A. Mohammad, A. Fadelmansour, and B. K. Jalal, "Legal Liability Arising from Artificial Intelligence Activities," *Journal of Ecohumanism*, vol. 3, no. 6, pp. 338–346, 2024.

[68] M. Chawki, M. Al-Minshawy, and M. S. Abdelaty, "Smart robots (robots as a model) and the scope of their protection in criminal law: A grounded analytical study," *Arab Journal of Forensic Sciences and Forensic Medicine*, vol. 5, no. 1, 2023, pp. 104–122.

[69] F. Pasquale, *New Laws of Robotics: Defending Human Expertise in the Age of AI*, Cambridge, MA: Harvard University Press, 2020. https://doi.org/10.1007/s00146-021-01226-9.

[70] H. S. Alabady, "Towards a legal framework for civil liability of smart robots in Jordanian legislation," *International Journal of Cyber Criminology*, vol. 17, no. 1, 2023, pp. 23–39. https://doi.org/10.5281/zenodo.4766602.

[71] M. I. Al-Khatib, "Civil liability and artificial intelligence," *Kuwait International Law College Journal*, vol. 8, no. 29, 2020, pp. 107–152.

[72] A. R. Al-Maadawi and M. A. Mujahid, "Civil liability for robots with artificial intelligence: a comparative study," *Legal Journal*, vol. 9, no. 2, 2021, pp. 283–392.

[73] S. M. A. Al-Maaitah, F. T. Alqudah, M. B. M. Arabyat, and W. Amayreh, "Civil liability for medical robot damages according to artificial intelligence applications," *Migration Letters*, vol. 21, no. 7, 2024, pp. 1694–1705.

[74] M. Abdel Latif, "Liability for Artificial Intelligence between Private Law and Public Law," Mansoura Journal of Legal and Economic Research, Special Issue, vol. 2, pp. 2–52, 2021.

[75] A.R. Ahmed, "Civil Liability for Artificial Intelligence Damage," *Generation of In-depth Legal Research Journal*, vol. 43, pp. 19–33, 2020.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

The authors equally contributed in the present research, at all stages from the formulation of the problem to the final findings and solution.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.