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***Addressing The Challenges Of Attributing Responsibility For Wrongful Acts Committed By  
Autonomous Systems And The Implications For State Accountability Under International  
Law***

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**ABSTRACT**

*The technological advancement is the rapid outgrowth as per human needs and necessities, for various factors such as handling in hazardous process, accomplishing more complex tasks and etc. in the rapid growth of urbanization and industrialization it is significant to for such evolution of technological advancement, the core purpose for the evolution would be to reduce burden in human and assist them with accomplishing the risky tasks, this has been now brought new evolution and moved into next level such as Artificial intelligence and Machine Learning which not even require the participation of human that can act independently or autonomously thus based on their activity they are categorized into fully autonomous, semi-autonomous and supervised autonomous systems some of the examples include self-driven cars, autonomous robots, autonomous drones, autonomous warfare and industrial systems and etc, these autonomous systems are categorised and in usage based on their certification by some of the domestic and international agencies those standards are discussed below in detail, since the artificial intelligence and machine learning are new to the world there is no legal governance in the world, further an international framework has been examined where treaties has been proposed and the countries which is been ratified has governed under such laws however many challenges faced by the public and accountability of state such as Digital dehumanisation, algorithmic biases, loss of human control, lack of accountability and etc. This has been addressed and various solutions or the recommendations has been explained hereunder.*

**Keywords:** *Autonomous systems, International Framework, Attributing challenges.*

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### **Introduction**

In the growing technological era, the automated systems are the more significant part, they can be observed in two aspects namely artificial intelligence and machine learning, those systems can be designed to create similarity as a human to do activities such as gaining experience from work, fixing within the environment, adopting to work culture and etc. in the aspect of decision making process it involves in data collection, processing such data, make decisions based on the data available and actions to the decisions made. The autonomous systems can be body comprising of hardware and software systems. In simple terms the automated systems are the technological systems which can operate independently without human intervention or support. Initially in the middle of 20<sup>th</sup> century these systems are used in assistance for human in small works and projects but later due advancements in AI algorithms, computational power and sensor technology has enabled this system and it has now entered to accomplishing complex project and achievements such as leveraging advance in artificial intelligence, machine learning, sensors, and robotics, it is the crucial and well advancement that the autonomous drones is used in military applications and the rapid rush in the self-driving cars<sup>2</sup>.

The automated systems however, become the inevitable thing in day to day lives it has bound to do multiple wrongful acts for the reason they have the potential to behave in unpredictable ways on being autonomous thus, the challenges faced by such systems would be addressed and it is the responsibility to develop those systems effectively and trustworthy among the people. The systems shall be constantly monitored whether they stick with the legal norms and social values.

The research raises question on how do autonomous system combat the traditional notions of responsibility and accountability, accountability of state in international law and its implications, analysing the existing international laws and principles to address the matters and the potential consequences of failing to address these challenges. This paper aims in

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<sup>2</sup> European Commission, Directorate-General for Communications Networks, Content and Technology, (2019) *Ethics guidelines for trustworthy AI*. Publications Office. <https://data.europa.eu/doi/10.2759/346720>



addressing the challenges while handling the autonomous system committing wrongful acts and the duties of state to address such matters firmly aligning with the international law.

### **Autonomous systems**

The autonomous system are the systems which can observe the environment and achieve its goals by gathering information and understanding the data from the environment and work without human intervention irrespective of the time.

Examples of autonomous systems include

- **Autonomous vehicles popularly known as self-driven cars**

Autonomous vehicles or the self-driving cars are the more prevalent and evolving stages that took place in both passenger and commercial vehicles, they are completely autonomous and partially autonomous base on the six levels of driving automation mentioned in SAE J3016. From this the standards are of two,

- a) SAE levels 0-2 – they possessed with autonomous steering, braking and acceleration support but provided with driver support and collision avoidance warnings had provided.
- b) SAE levels 3-5 – they are considered to be fully autonomous that can take passenger without driver and carry cargo in all conditions.

A survey has states that up to 50 percent of passenger vehicles being highly autonomous and 15 percent being fully autonomous vehicles of new sold cars in 2030 would be completely autonomous cars would commercially be available, from this advanced driver assistance systems (ADAS) would be turning point which replaces the drivers into preparing regulators, direct consumers and the corporations. The technologist and the startups are rapidly in motion to achieve this level where these systems require no driver for entire trip<sup>3</sup>.

- **Autonomous robots**

Autonomous robots are the copy of human which involved in the physical and complex activities it accomplishes work from simple floor cleaning to complex autonomous helicopters. Otto, a first autonomous robot works as runway cleaner at airport in Manitoba.

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<sup>3</sup> Paul Gao, Hans-Werner Kaas, Detlev Mohr & Dominik Wee, *A Roadmap to the Future for the Automotive Industry*, McKinsey & Co. (2016).

Those are categorised and in force in various field such as in agriculture autonomous tractors, milking machines and strawberry-picking robots which involve in high accuracy may in operation, in the field of medicine robots assist surgeons such as coronary artery bypass and cancer removal and four-legged walking robots which can helps in navigation and used in highly hazardous works.

- **Autonomous drones**

Autonomous drones are the self piloting aircrafts affixed with camera or other sensors for performing various functions such as reconnaissance, surveying, asset inspection and environmental studies. The wide use of this would involve agriculture, inspection and army usage for spying.

- **Autonomous warehouse and factory systems and etc**

Autonomous warehouses which involve in small to high risk works one of the examples include the robot forklift that moves products around ecommerce distribution centre and such shall also involve in welding, painting, finishing and packaging.

### **Kinds of Autonomous systems**

The autonomous systems are classified based on the functionality and includes,

- 1. Fully autonomous system**
- 2. Semi-autonomous system**
- 3. Supervised autonomous system**

- 1. Fully autonomous systems** are those which acts independently without any command or control over the systems, they shall use digital processes to accomplish objectives and make independent decisions. Those systems shall be involved in highly hazardous process or accomplishing complex activities, it has advantages as well as disadvantages, advantages include consistency and elimination of human error, cost effectiveness over time, and preservation of human resources and disadvantages includes causing damage to law and ethics, damage in case of error and etc.
- 2. Semi-autonomous systems** or the systems which can operate autonomous but can't complete the entire task of itself, looking practically the autonomous systems are the more



prevalent form of systems that is in place all around the world further to illustrate semi-autonomous wheelchairs, robotic tractors and General Motor's EN-V city vehicle. The semi-autonomous systems are further classified based on their performance or activities such as human has superior authority over the system, human operator may not have authority but can be used, human operator have different level of competence based on their activities<sup>4</sup>.

3. **Supervised autonomy systems** are the system that can be acted autonomous with the supervision of the human which helps in enhancing the safety machine interaction and high productivity and further it bridges the gap between teleoperated robotics and full autonomy. The supervised autonomy would also be a well aligned with the human having control over them which in case causes any fault may stop such activity and may have a human robot interaction and co-ordination.

#### **Certification of autonomous systems**

The systems developed and to be taken in force with the human society or lives might mandatorily comply with the legal requirements, the legal requirements are the standards fixed by the experts and thereby considered to be regulations, laws, rules etc. which shall be authorised for safe usage.

The standards of systems can be proposed by different standardisation organisations which are popularly known such as CENELEC, the European Committee for Electrotechnical Standardization, IEC (International Electrotechnical Commission), IEEE (Institute of Electrical and Electronics Engineers standards Association), ISO (International Organization for Standardization). Many of these certifying organisations may provide the generic standards across autonomous system domains<sup>5</sup>.

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<sup>4</sup> Zilberstein, S. (2015) "Building Strong Semi-Autonomous Systems", *Proceedings of the AAAI Conference on Artificial Intelligence*, 29(1). doi: 10.1609/aaai.v29i1.9773.

<sup>5</sup> International Civil Aviation Organization (ICAO), *Autonomous Aviation Systems: A Regulatory Approach* (2021), <https://www.icao.int/>.

**Standards**

<b>Code</b>	<b>Title</b>	<b>Year</b>	<b>Abstract</b>
ANSI/RIA	Robots and robotic devices safety requirements for Industrial mobile robots	2020	Requirement for the design and integration of such robots, ensuring worker safety near them.
ISO10218-1, ISO 10218-2	Robots and robotic devices – collaborative robots	2021	Safety requirements for collaborative industrial robot systems and the work environment, supplementing the requirements and guidance on collaborative industrial robot operation given in ISO 10218-1 and ISO 10218-2.
IS/ISO 20242: Part1: 2005/ISO 20242-1:2005	Industrial automation systems and integration- service interface	2022	Industrial automation systems and integration- service interface for testing applications: Part 1 overview and measuring of safety measures.
ISO 10218- 1:2023 and ISO 10218-2:2023	Robotics – safety design in Industrial Environments	2023	Safety requirements for the robotic manipulator, controller and teaching pendant, particularly for manufacturers of industrial robots.
IEEE 1872.1	Robotics – Robot task representation	2019	Framework for defining and representing robot tasks ensuring clear communication and interoperability across different robotic systems
ISO 13485	Medical device	2023	Aims of harmonizing regulatory



	manufacturing		requirements in medical device manufacturing.
ISO 34503	Operational design domain – Automated driving systems	2023	Aimed at fixing the standards of domains of the operational design domain and automated driving systems
ISO/TR 5255-2	Intelligent Transport Systems – Low-Speed Automated Driving System	2023	Requirements of the basic role and functional model of applications for the services of LSADS.

### **International framework**

As autonomous technologies, including robotics, autonomous cars, drones, and artificial intelligence (AI), become more and more ingrained in daily life, an international framework for autonomous systems is essential. Establishing international norms, standards, and laws that guarantee national safety, morality, and collaboration is part of such a framework. The main ideas for a research paper on this subject are listed below.

#### **1. International Regulation and Governance**

Autonomous systems necessitate thorough international governance because of their global ramifications. Regulatory ambiguity arises from the absence of established legislation, especially when it comes to cross-border operations like drones and self-driving automobiles. Although the United Nations (UN), International Telecommunication Union (ITU), and International Civil Aviation Organization (ICAO) are among the international organizations that have begun to address these issues, more uniformity and precise definitions are still required. To avoid contradictory restrictions, national governments must coordinate their domestic legislation for autonomous systems with international accords. Consistency in safety standards and operations could be ensured by harmonizing regulations across borders through a single legal framework.

## **2. Decision-Making and Ethical Standards**

The moral judgment of AI and robotics is a significant problem in autonomous systems. Autonomous cars, for example, need to be able to make moral choices when it comes to life or death. The definition of "ethical" decision-making algorithms must be agreed upon by the international community.

The ethical standards of various nations can influence how autonomous systems are developed and how their behavior is assessed. Principles like accountability, transparency, and equity can be established by a global ethical framework to direct the development of autonomous technology.

The EU has taken action in this area with its Ethics Guidelines for Trustworthy AI, which emphasize human oversight, transparency, and the prevention of bias, offering a potential model for global standards.

## **3. Standards for Safety and Security**

Strict safety regulations must be followed by autonomous systems to prevent mishaps and injury. Autonomous vehicles, for instance, must undergo extensive testing for real-world obstacles such as road conditions and crash scenarios.

Another crucial element is security. Cyberattacks can target autonomous systems, particularly those with internet connections. To protect these systems from hacking or malfunction, an international framework should set cybersecurity standards, including encryption protocols, risk assessments, and fail-safe measures.

Safety standards for autonomous systems are currently being developed by groups like the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO), and their widespread adoption could help avert catastrophic failures.

## **4. Protection and Privacy of Data**

Large volumes of data are produced by autonomous systems, which creates privacy issues, particularly when sensitive or personal data is involved. A global framework that





establishes uniform standards for data collection, storage, and use could aid in preserving people's privacy.

The degree of privacy protection varies by country. While many nations lack comparable protections, the EU's General Data Protection Regulation (GDPR), for instance, places a strong emphasis on individual rights over data.

Users' ownership over their personal data, transparency in the application of AI algorithms, and data protection for individuals can all be guaranteed by an international data governance framework.

### **5. Standardization and Interoperability**

Even if autonomous systems are produced by different companies or originate from different countries, they must be able to communicate and cooperate. For example, to guarantee smooth and secure operation, self-driving cars from various manufacturers should be able to exchange information about barriers or road conditions.

Incompatibilities can be avoided and improved coordination between systems from various manufacturers and nations is made possible by international interoperability standards. Communication standards for autonomous systems are already being developed by groups like the IEEE and ITU, and they may eventually become widely recognized standards.

### **6. International Cooperation and Study**

International cooperation is necessary to address the special problems posed by autonomous systems. The safe and efficient use of these technologies will be accelerated by the creation of frameworks that encourage collaborative research, resource sharing, and information sharing.

International research consortia and collaborative platforms, such as the Global Partnership on AI (GPAI), can offer important insights into the advancement of autonomous technology, enabling nations to pool resources and exchange best practices.

### **7. Effect on the Economy and Employment**

Significant economic ramifications will result from the widespread use of autonomous systems, particularly in industries like manufacturing, logistics, and transportation. An international framework might support retraining initiatives for people impacted by

automation and make it easier to develop policies to manage economic changes like labor displacement.

With an emphasis on lowering inequality, nations must work together to guarantee that autonomous technologies support global economic progress. Cross-border cooperation on technology education and job retraining, for example, may aid employees in adjusting to the shifting environment.

### **8. Effects on the Environment**

Autonomous systems have the potential to drastically lessen the environmental effect of conventional modes of transportation, particularly electric cars and drones. While reducing the carbon footprint of widespread adoption, a worldwide framework could encourage the development of environmentally beneficial autonomous technology.

The creation of autonomous systems that promote sustainable objectives including cutting emissions, improving energy efficiency, and assisting in the fight against climate change could be encouraged by international accords.

#### **Accountability of state**

Accountability of states regarding autonomous systems is a vital concern that intertwines law, technology, ethics, and international relations. As autonomous systems progress and become integrated into different industries, the issue of accountability for their actions—particularly when errors occur—grows more intricate. This complexity is further intensified by the absence of explicit legal frameworks to direct state accountability, complicating the process of holding governments or human agents responsible for damage inflicted by autonomous technologies.

In the sphere of international law, countries are typically responsible for making sure that the behaviors of both state agents and organizations within their authority do not cause harm to others. Nonetheless, autonomous systems, especially those exhibiting significant decision-making independence, pose a challenge to conventional accountability frameworks. Autonomous systems, including self-driving cars, drones, or military robots, are frequently created to make choices without direct human involvement. This brings up the question of



whether the government is accountable for the actions taken by these systems, particularly if those actions result in damage or violations of international law.

A fundamental problem with state accountability regarding autonomous systems is establishing the legal status of the systems in question. When an autonomous system inflicts damage, it leads to the inquiry of whether the system should be regarded as a representative of the state, making the state accountable, or if it is a separate entity whose actions shouldn't be linked to any state authority. Without explicit regulations, states may not feel obligated to be accountable for the actions of autonomous systems, especially when the technology is managed by private companies or individuals.

To tackle this issue, governments must establish regulatory frameworks that outline the duties of developers, operators, and authorities concerning autonomous systems. These frameworks must guarantee that accountability extends beyond just the producers of the technology, encompassing also the state entities that authorize the use of these technologies and establish the criteria for their application. Clarity in decision-making processes and methods to evaluate autonomous systems will be vital for ensuring governmental accountability.

In addition, global collaboration will be crucial for tackling concerns of state accountability internationally. Autonomous systems disregard national boundaries, and their activities can lead to international repercussions. For example, a self-governing drone controlled by one nation might inflict damage in the territory of another nation, prompting inquiries regarding who is responsible for the drone's actions. Joint initiatives among states are essential to establish cohesive standards and norms that guarantee accountability and avert technological abuse.

In summary, the responsibility for autonomous systems is a pressing and developing matter. To make certain that states are accountable for the consequences of autonomous systems, strong regulatory frameworks, international collaboration, and transparency in technology implementation are vital. These actions will aid in guaranteeing that the advantages of autonomous systems are achieved while reducing threats to human rights, safety, and global security.

### **Attributing challenges**

#### **1. Digital Dehumanisation:**

The rapid growth of the autonomous systems may lead to rapid decline in human involvement over any tasks or outgrowths, the usage is for human lives but the systems may decline its usage would be great challenging to the humans. Allowing this further would cause harm to human evolution causing decline in their usage of their intellect and threat to decision making by the human.

#### **2. Algorithmic biases:**

In case of the autonomous weapons the human shall be targeted, likewise the algorithm has been programmed which allow the systems to reinforce or exacerbate existing structures of inequality. This programming in case of automated weapons would allow the automated systems to abridge the human lives.

#### **3. Loss of meaningful human control:**

The fully automated systems would not require any control it would be of completely autonomous and make decision of their own and act in its own manner such would have a loss of human control and there is chance of making wrong.

#### **4. Lack of human judgement and understanding:**

The autonomous systems are the complex form of systems where the people had less knowledge over the systems further the fully autonomous control lacks human knowledge and control thus leads to lack of control.

#### **5. Lack of accountability:**

It is not reasonable to accuse machines for the accountability and so the human shall be held accountable for the actions or the consequences of the systems.

#### **6. Inability to explain what happened or why:**

The system that is fully autonomous or the control might have no control and act in autonomy that causes damage or harm to the public can't be reasonable to explain thus it leads to injustice those may occur due to inability to explain what happened or why.



## **7. Relationship with Technology:**

Technology is developed to empower the people lives it shall not abridge their lives, both should be in line to make a proper progress and empower the society at large and thus in autonomous systems it lacks the correspondence<sup>6</sup>.

## **8. Environmental impact on self-driving cars:**

The self-driving cars may have unpredictable weather and further the road conditions are highly unpredictable, they shall not be in consonance with the traffic conditions and the main cause such as accident liability which is been a major question in dealing with the accident matters who will be held liable in cases such as google self-driving car is not provided with steering control or the dashboard in that case the passenger shall not make a control this would be a greater defect to the system<sup>7</sup>.

### **Solutions (or) Recommendations**

- a) Usage of semi-autonomous and supervised autonomous systems would be more effective and would be under the control of the human rather fully autonomous which causes the process of dehumanization.
- b) The autonomous systems shall not be coded to violate rights of human, it would lead to severe harm to mankind, especially in the case of autonomous guns which is used for war in which the systems cannot identify the difference to whom he is being targeted rather it would keep them in a single category of human.
- c) Avoidance of machine supremacy shall be made, machine autonomy would eradicate the cultivation of human lives and thoughts thus the machine autonomy must be under the control of humans, not offensive to the humans itself. The autonomous systems shall not supersede over the control of humans.
- d) The human shall apply the mind and make decisions in matters it is dealing with and not the machine which is possessed with decision making skills, which may perpetuate and shall cause mental disability.

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<sup>6</sup> *Facts About Autonomous Weapons*, STOP KILLER ROBOTS, <https://www.stopkillerrobots.org/stop-killer-robots/facts-about-autonomous-weapons/> (last visited Jan. 22, 2025).

<sup>7</sup> Akshitha Karnati, Devanshi Mehta & Manu K S, Artificial Intelligence in Self Driving Cars: Applications, Implications and Challenges, 21 *Ushus J. of Bus. Mgmt.* 1 (2022), <https://doi.org/10.12725/ujbm.61.1>. <https://www.iiot-world.com/artificial-intelligence-ml/artificial-intelligence/five-challenges-in-designing-a-fully-autonomous-system-for-driverless-cars/>

- e) The legislation for the control of autonomous systems should be enacted in domestic law to control within the states and the international ratification for dealing with the inter-nations where the trade or agreement to be made.
- f) No explicit law is in place for the nation in handling the autonomous systems or machine learning technology so specific special enactments shall be made domestically as well as internationally.
- g) Complete dependence on the autonomous causes the humans less accountable and if the system has committed any wrong or harm the liability for commission of such harm is a question that whom is liable for commission of such wrong, that shall be addressed and resolved.
- h) The technology must be in line with the human needs but these autonomous systems acts on its own and there is larger impact of creating severe harm to the society thus specific guidelines for addressing the same shall be formed.
- i) Self-driving cars shall be provided with steering and control levers or objects for accident, damage or any severe harms.

### **Conclusion**

In summary, the emergence of autonomous systems poses notable challenges and intricacies, especially concerning responsibility, accountability, and governmental oversight under international law. As these systems advance and merge into different fields like transportation, military, and manufacturing, their capacity for both beneficial effects and harmful consequences becomes more evident. The erratic behavior of autonomous systems, exacerbated by algorithmic biases, diminished human oversight, and insufficient accountability, calls for the establishment of strong regulatory frameworks at both national and international scales.

The difficulties related to assigning responsibility for wrongful actions carried out by autonomous systems are significant, especially when there are no defined legal frameworks to hold human operators or government entities liable. This problem is made more complex by the lack of transparency in decision-making processes within fully autonomous systems



and the ethical challenges they pose. Consequently, it is essential to create thorough standards that regulate both the technical elements of these systems and also tackle the ethical, safety, and security issues they present.

Global collaboration will be essential in establishing a cohesive strategy for the regulation and management of autonomous technologies. By harmonizing standards, promoting transparency, and guaranteeing accountability, states can reduce the dangers associated with autonomous systems while enhancing their capacity for societal advantage. Additionally, it is essential to guarantee that the advancement and implementation of these technologies stay in accordance with human rights, safety, and ethical standards to uphold public confidence and nurture a constructive connection between technology and society.

Ultimately, although autonomous systems can revolutionize industries and enhance lives, their thoughtful incorporation into society demands meticulous planning, continuous regulation, and global cooperation. Only by means of these endeavors can the difficulties of assigning responsibility and guaranteeing state accountability within international law be tackled effectively, ensuring that autonomous systems.