Original Research Article

A Multi-Stakeholder Perspective on the Limitations of ImplementingArtificial Intelligence in Highway Transport

ABSTRACT

This research paper investigates the stakeholder's perspective on the limitations of implementingArtificial Intelligence (Ai) in highway transport. The study focuses on threeareas of limitation which are technical, regulatory and ethical barriers, it also offers recommendations on mitigationmeasures for policymakers, industry stakeholders, and researchers[1].Through an in-depth survey (questionnaire) analysis, the resultsshow that the major limitations highlighted based on the percentage by respondents/stakeholdersarelimited availability of Ai technology (42.6%), lack of government support (27.9%), the absence of industry-wide regulations (27.4%),job displacement (29.4%), privacy implications (25.5%), and cybersecurity risks (30.2%). These findings from the analysis reveals the perception of highway transport stakeholders on the limitations facing the adoption and implementation of Artificial Intelligence in highway transport.

Keywords: Artificial Intelligence; highway transport; limitations; ethical concerns; challenges; regulatory barriers; technical; stakeholders.

1. INTRODUCTION

One of the prime areas where AI will make its most paradigm-shifting impact is transport[3][1]**.**Highway transportation is the backbone of the global transportation system, accounting for more than 90% of total transportation worldwide. However, the highway transport system is facing numerous challenges, including traffic congestion, air pollution, accidents, and deteriorating infrastructure. Artificial Intelligence has the potential to revolutionize highway transport by improving safety, efficiency, and sustainability.Artificial Intelligence (AI) is a rapidly growing technology that is changing the face of transportation industries worldwide. The application of AI in the transport field is aimed at overcoming the challenges of an increasing travel demand, CO2 emissions, safety concerns, and environmental degradation[11].

However, Artificial Intelligence successful implementation requires careful consideration of technical, ethical, and regulatory issues. As such, continued research and development in this field are essential to ensure that Artificial Intelligence is used to its full potential while minimizing any potential negative impacts.While there are many potential benefits to using Artificial Intelligence in highway transport, there are also some criticisms and limitations to consider[1]. The experts noted that the growth of the world market for artificial intelligence in the coming years will be accompanied by ethical and social problems. These problems are called - unintended consequences of the use of artificial intelligence technologies[4].

Artificial Intelligence systems rely on vast amounts of data and complex algorithms to operate, which can increase thee risk of system failures or errors. Also, the use of AI-powered sensors and communication networks can make transportation systems more vulnerable to cybersecurity threats, potentially compromising the safety and security of the system. One of the most significant criticisms of Artificial Intelligence in highway transport is the potential for system failures and cybersecurity risks. With more data being shared and a larger dependency on data, cybersecurity is getting more important[2][1].Another limitation of Artificial Intelligence in highway transport is the potential for bias in decision-making. Ai algorithms are only as unbiased as the data used to train them, and if the data is biased or incomplete, the resulting decisions may also be biased. This can lead to discrimination against certain groups of people or communities.Therefore, Ai solutions have the potential to support or even take over control of humans to deal with the large amount of data and the complexity of control in (real-time) situations[2]. Furthermore, the implementation of Ai-powered transportation systems requires significant investment in infrastructure and technology, which may not be feasible for all communities or regions. Rural areas or developing countries e.g. Nigeria may not have the resources or expertise to implement and maintain Ai-powered transportation systems, leading to disparities in access to transportation.Technologies like Artificial Intelligence are in potential ground-breaking, but applications are only just starting to use them, discovering what is already possible and what still needs to be developed[1][2].Another limitation is the potential impact on employment in the transportation sector. The automation of transportation through the use of Ai-powered autonomous vehicles may lead to job losses for drivers and other transportation workers[2]**.**

Interest in artificial intelligence is growing from the side of science and practice. At the same time, it is difficult to predict the rate of penetration of artificial intelligence technologies into the lives of people and the activities of companies[4]**.**The findings of this research will provide insights into some of the limitations of implementing Aiin highway transport from a stakeholders perspective and also offer mitigation measures.Indeed, artificial intelligence, like any other innovation, changes the content of processes and allows you to get a slightly better result. There is still a lot of time and effort to spend on researching the results of using artificial intelligence technologies [4].

2. METHODOLOGY

This research aims to research the limitations of implementingArtificial Intelligence (Ai) in highway transport from amulti-stakeholder perspective and ways to address them. The study will use primary data sources to achieve its research objectives, with an online survey as the primary data collection method. In 2020, experts from the Gartner agency conducted a survey of respondents in order to identify the sentiments of company leaders regarding the use of artificial intelligence technologies. The result showed that more than 50% of managers plan to deploy the use of artificial intelligence technologies in their companies. This is 14% more than in the last year's survey[4].

Method of Obtaining Data

Data was collected from a total of 100 highway transport stakeholders using a surveyquestionnaire which was designed to encompassdiverse aspects of Artificial Intelligence applications in highway transport including the different limitations/barriers facing its adoption and implementation in highway transport[1]. The questionnaire consisted of a total of 20 questions, divided into four sections. For the purpose of this paper we will focus only on some of the charts from first and fourth section.

Section 1: Demographic Information (3 questions)

This section will collect information about the participants, such as their age, gender, and occupation.

Section 4: Challenges and Limitations (5 questions)

This sectioninvestigates the challenges and limitations of implementing Artificial Intelligence in highway transport, such as technical limitations, regulatory barriers, and ethical considerations.The surveyconsists of closed-ended questions andare designed to ensure that the responses provide the necessary information to achieve theobjectives of this research paper.

Survey Distribution

Utilizing digital platforms like Jotform, the survey was disseminated across various online channels, includingtransportation forums, academic networks, and industry-specific groups. The survey was accessible for a predetermined period to obtain a broad and representative sample.

Data Analysis:

The data collected through surveys, wasanalysed using descriptive statistics and Microsoft Excel as the tool for analysis. Descriptive statistics was used to summarize and present the survey results.

3. RESULTS AND DISCUSSION

Occupation

The results in Figure 1 shows the occupational diversity of the respondents with Engineers constituting the largest professional segment, with 60 respondents. Government officials making up the least segment with 4 respondents. The “Other” category encompassed 17 respondents, potentially including various professional backgrounds not explicitly listed.

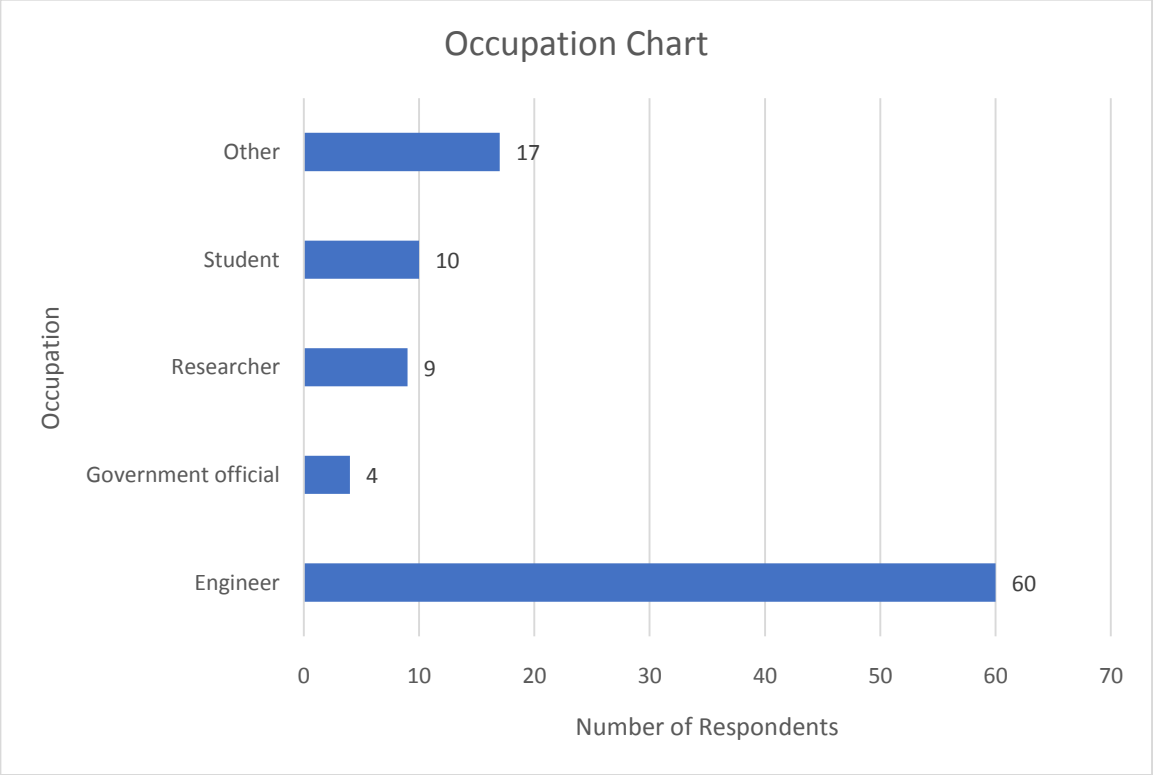

Fig.1. Occupation Chart

Technical Limitations

The survey findings highlight various technical challenges perceived by respondents in implementing Artificial Intelligence within highway transport. A significant proportion raised concerns about the limited availability of Ai technology (42.6%), followed by data privacy issues (29.4%) and the absence of standardization (27.9%).

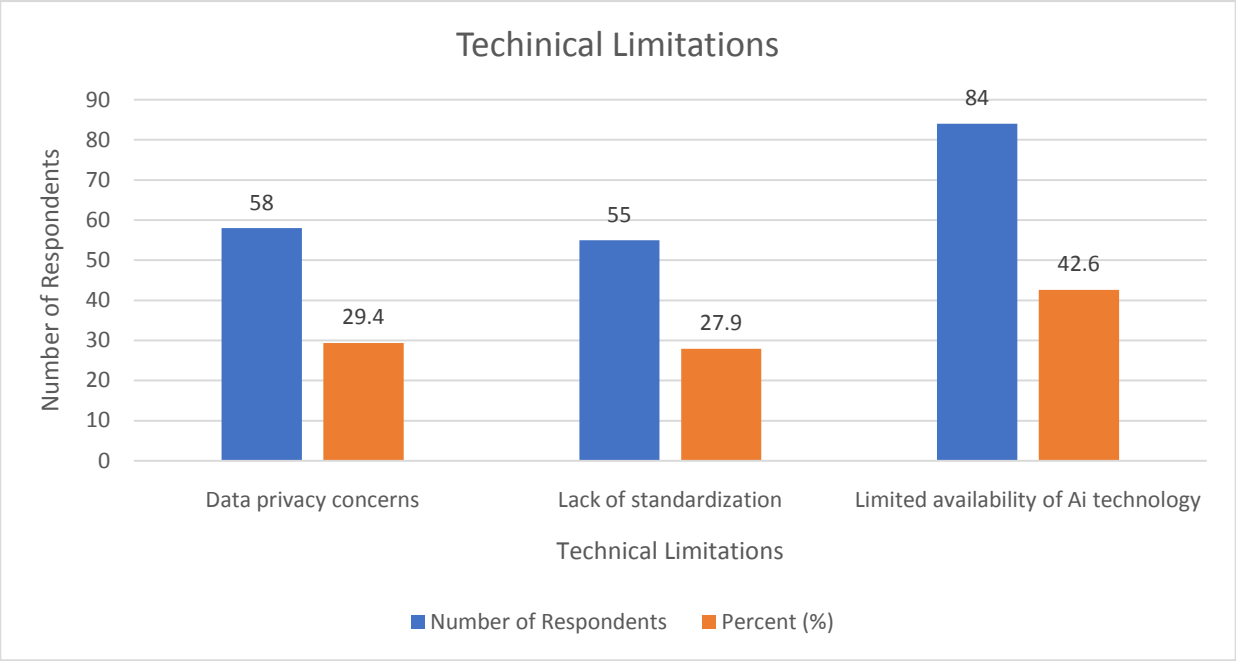

Fig. 2.Technical Limitations Chart

Regulatory Barriers

The results show various regulatory hurdles perceived by respondents in implementing Artificial Intelligence within highway transport. Legal liability concerns (21.2%), lack of government support (27.9%), challenges in obtaining permits (23.5%), and the absence of industry-wide regulations (27.4%) were the primary issues highlighted.

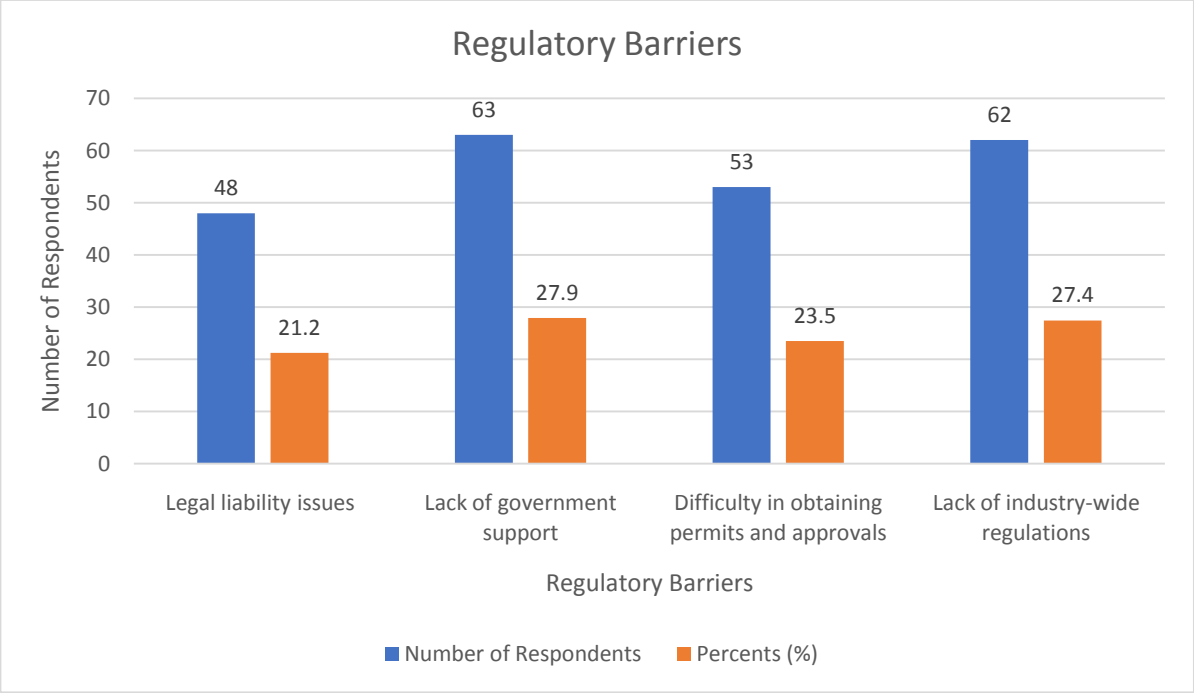

Fig. 3. Regulatory Barriers Chart

Ethical Considerations

The insights from Figure 3 emphasize various ethical concerns associated with integrating Artificial Intelligence in highway transport. Concerns about job displacement (29.4%), biases in Ai algorithms (14.9%), privacy implications (25.5%), and cybersecurity risks (30.2%) were the prominent issues highlighted by the respondents.

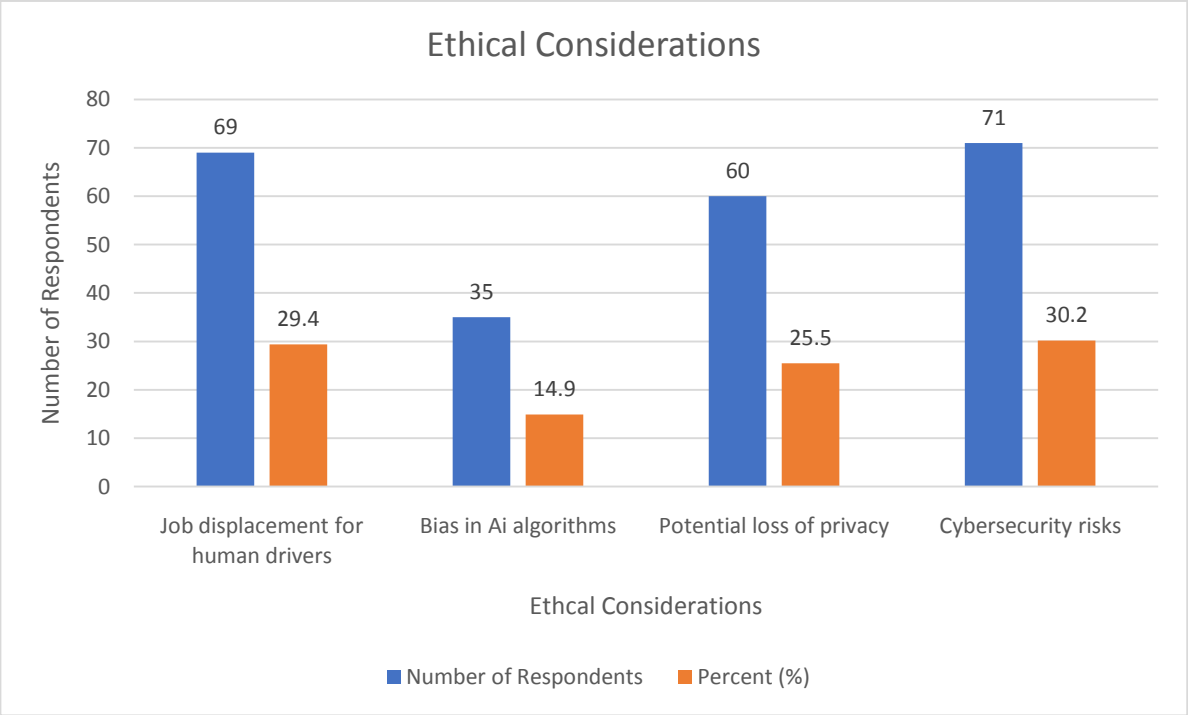

Fig. 4. Ethical Considerations Chart

Addressing the Limitations

The responses from research survey signify various strategies suggested by respondents to mitigate the limitations and challenges associated with implementing Artificial Intelligence in highway transport (Figure 5). The recommendations largely centre on regulatory frameworks, enhanced cybersecurity, algorithm transparency, and public engagement to address ethical concerns.

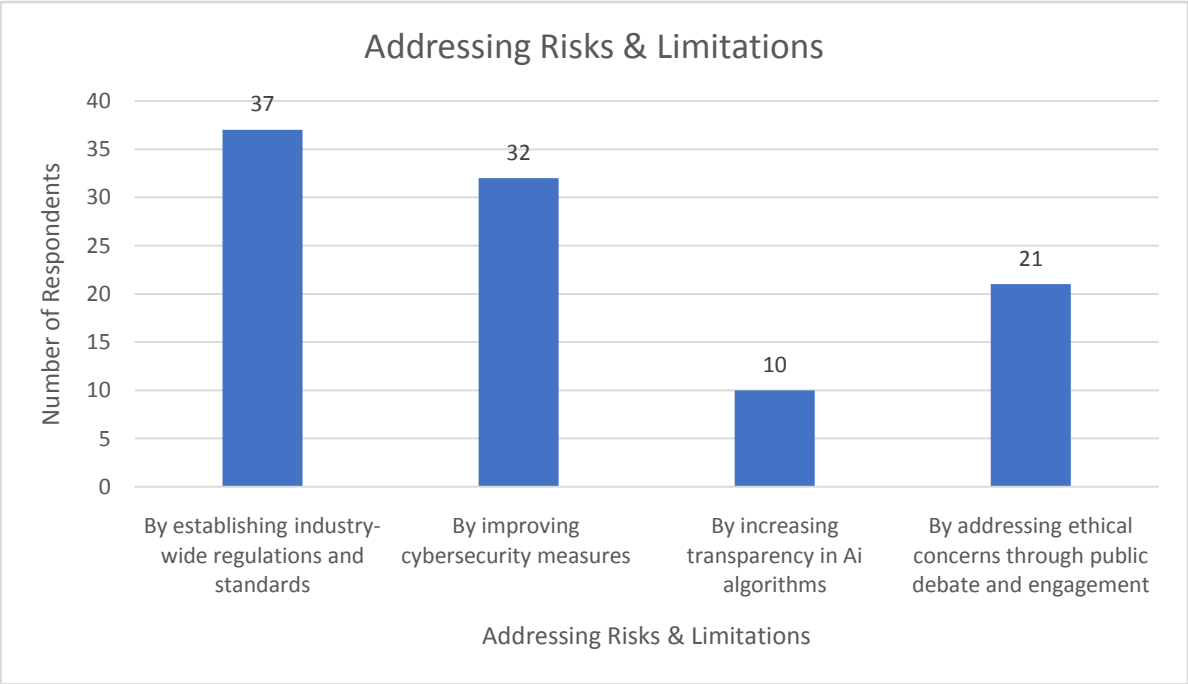

Fig. 5.Addressing the Limitations Chart

4. CONCLUSION

With the primary aim of this research paper in mind which is to analyse and present the limitations associated with the implementation of artificial intelligence in highway transport from a multi-stakeholder perspective and mitigation measures.The demographics results of this research survey shows that the participants in the survey were majorly highway transport professionals which is evident in the occupational distribution with 60% responses from engineers. From the various papers reviewed in this research [5], shows that there are different challenges facing the implementation and adoption of Artificial Intelligence in highway transport[8][1]. This research focused on technical limitations, regulatory barriers and ethical barriers from stakeholders perspective. The results of the survey conducted, shows the diverse perception of barriers to implementing Ai in highway transport and more importantly various ways to address these issues which are; establishing industry-wide regulations and standards, improving cybersecurity measures, increasing transparency in Ai algorithms, addressing ethical concerns through public debate and engagement.

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