Stellar Solutions

Canadian Consulting Company

Info@NimaYoung.ca
647.909.2733
North York, ON

Re: York University
Autonomous Vehicle Feasibility Report

Dear Client,

Stellar Ltd is proud to submit the following report assessing The Feasibility of Autonomous Vehicles. This assessment was prepared based on the terms outlined in the course outline, dated Jan 2024.

Please find on the following pages: the problem background, relevant research, implications, and solutions proposed.

Please do not hesitate to reach out with any questions or concerns. Our offices have been instructed to handle your call with the utmost care.

Cordially,

Nima Nojavan

Nima Nojavan
Director
Stellar Solutions

2024

AUTONOMOUS VEHICLES FEASIBILITY REPORT

PRESERVE OVER ONE MILLION LIVES ANNUALLY

Stellar Solutions
Autonomous Vehicles

Executive Summary

Enclosed you will find the report which was created for the purpose of assessing the feasibility of autonomous vehicles and their role in the future of mankind. This assessment stems from a striking challenge found in an article published by BBC titled: *50 Grand Challenges for The 21st Century*. The challenge was presented by Larry Burns, former corporate vice president of Research and Development for General Motors, who claimed the adoption of Autonomous Vehicles could preserve over one million human lives annually.

It has been found that although autonomous vehicles are a new technology, their adoption is forecasted earlier than generally anticipated. With over ten thousand articles sited, it has been concluded that the intrigue for this idea is showing growing promise signalling a willingness to entertain its development [4].

Readers may find a high level overview of the subject in the introduction. All concepts and definitions used can be found in the background and are presented to aid your understanding of this report. Following, you may find the methodology employed and the results, which are discussed further in the discussion section. For a high level overview of the findings, you may refer to the conclusion section which summarized key points gathered.

Any and all figures, charts, and diagrams are located in the appendix. Stellar would like to thank you for this opportunity and welcomes all questions or concerns regarding this report.

Cordially,

Nima Nojavan

Nima Nojavan
Director
Stellar Solutions

TABLE OF CONTENTS

1.0 Introduction 1

2.0 - Background 2

2.1 Terms 2

2.2 Levels of Automation 2

3.0 - Methodology 3

4.0 - Results 4

4.1 Table 1 4

6.0 - Discussion 5

7.0 - Conclusion 6

9.0 - References 7

10.0 - Appendix 8

INTRODUCTION

One million and two hundred thousand people face the most brutal consequence of car accidents annually; every year we lose 1.2 million people to car accidents. 90 percent of these accidents can be reduced with the mass adoption of autonomous vehicles (AVs), however, there are many challenges yet to overcome in ultimately reaching mass acceptance of AVs.

The most fundamental problems concerning the feasibility of AVs are outlined herein alongside the solutions currently being emplyed in adressing these concerns. All definitions and concepts outside of the common understanding related to vehicles and affiliated technologies are outlined in the background section below. This report is based mainly on eight articles, each uncovering a specific factor impacting AV adoption.

One article found, through reviewing over ten thousand papers regarding the topic, that the intrigue for AVs are growing over time, demonstrating both a need for this technology and a willingness of the general populous to entertain its development [4]. The environmental impact of AVs were also assessed in an article reviewed and it was acknowledged that traditional vehicles are established as the main carbon contributor [3], begging the argument that any reduction in the use of such vehicles will yield an equal reduction in carbon emissions. It is also acknowledged that traditional cars lead to noise pollution which is negatively impacting public well-being. Since the aforementioned problems can be solved with the adoption of electric vehicles (EVs), which do not need to be AVs, a concern arises regarding a justification for the development of this specific technology.

The main concern with autonomous driving is it's potential to reduce traffic accidents due to a uniform and logical coordination between cars. From the analysis done in this report, it is reasonable to believe that the more autonomous vehicles adopted in comparison to traditional modes of transportation, the higher the success rate will be in reducing traffic accidents; AV adoption is inversely correlated with both, traffic accidents and fatality rate. This is because autonomous vehicle adoption translates to a lower number of human drivers, and dually because coordination is transferred from individual drivers to a global network which can efficiently navigate traffic, reducing accident frequency and congestion as a whole.

In the pursuit of outlining challenges in achieving mass adoption of AV technology, the levels of autonomy are defined and challenges are categorized for each level. This report aims to effectively present information, and through this, create a better understanding of complexity and severity of each challenge.

BACKGROUND

Found below are useful definitions to enrich your understanding of the report enclosed.

Terms

Autonomous: Ability to self-govern.
Bibliometric: Statistical analysis of bibliographic data.
Disengagements: Disconnection of the autonomous system.
Scientometric: Qualitative analysis of scientific research.

Levels of Automation [7]

1- Most driving functions are manual
2- At least one system is automated
3- Safety critical systems are automated
4- Fully autonomous but not every scenario
5- Fully autonomous in every scenario

Autonomous: Having Both The Power and Right to Self Govern.

**Autonomous Vehicles, herein referred to as AVs.
**Electric Vehicles, herein referred to as EVs.

METHODOLOGY

In initiating this report, autonomous systems were first analyzed through the information available in the general world wide web and their development was assessed. Having outlined a rough background on AVs, google scholar and OMNI library were consulted. Through this research, all major problems were outlined alongside their respective solutions. It shall be noted that these solutions are mostly in progress and have not been implemented to completion. Furthermore, solutions to some challenges remain unattempted.

All sources found through the research stage were recorded. A table was constructed, wherein each source was broken down into its components; the information found from these sources were concentrated in a table. This stage was implemented as a means to organize information for future reference and use. This table can be found within the Appendix section, at the end of this report.

As problems found in this analysis were complex in nature, levels of autonomy were first defined and each problem was further categorized into sets of smaller problems/challenges and assigned to the level they impacted the most. In this fashion, all information available could be addressed more directly. These problems and their components can be found in the results section on the next page.

All components, after decomposition of each major problem, were analyzed, and patterns, if any, were identified. Through this approach, the challenge which impacted the most categories was effectively identified and addressed first. These patterns can also be found in the result section on the next page. The results are summarized within the discussion section alongside potential solutions proposed and assessed. To elaborate, each solution is quantitatively assessed based on a decision matrix available within the discussion section. Accordingly, the most suitible decision is pinpointed and briefly discussed in the next steps portion of this report.

Considering the nature of this report, no solution is discussed to a great extent. Rather, the main discussion sarrounds the feasibility of autonomous vehicles and the current climate. In concluding this report, all findings and discussions are summarized and presented.

RESULTS

The main challenges found in assessing AV adoption are: disengagements, governing, policy, and AV perception. The levels of autonomy, one through five, are impacted by these challenges in different ways. The levels of autonomy could be viewed as stages in the adoption of AV technology. Level one, vehicles controlled manually, and level two, at least one automated system, are understandably the least impacted by these challenges as they do not require great amounts of care to implement and will not result in major accidents when faulty. Level three, automation of safety critical systems, is the most crucial level of automation which is challenged almost exclusively by the disengagements of the autonomous vehicles during normal function [1]. This level is important in the adoption of AVs as the assumption of such technology would be the first real step by humans in adopting AVs. The failure of systems in this category translate to tragedy, and therefore, the correct implementation of it is very important. Level four, Fully autonomous but not in every scenario, and Level 5, fully autonomous is every scenario, are the last two levels which are dependant primarily on the correct implementation of Level 3 systems. The adoption of the Level 3 systems are then the most relevant challenge the auto industry faces to date; the correction of the disengagements problem could mean the first major step towards AV adoption.

The most common problem at a micro level, after assessing all challenges, is the lack of real world data [1]. This is the absence of enough data points to draw reliable conclusions and make true projections concerning the outcome of AV adoption. This problem impacts all levels of adoption, including level 3 technology. This problem impacts electronics built and cascades into a secondary problem of flawed electronics. With the increase in data points, the auto industry can expect better and more clear insight into creating technology free of faults.

Challenge	Level Impacted	Problem Components
Disengagements [1]	Level 3	• Lack of Real Data • Faulty Electronics
Governing and Policy [2]	Level 4	• Lack of Real Data • Topic Controversy • Concern for Safety
AV Perception [6]	Level 5	• Lack of Real Data • Topic Controversy • Concern for Safety

Discussion

The main problem identified in the path to EV adoption is the lack of real world data.
To combat this, four solutions are assessed.
1) Incentivizing the adoption of EVs through government funding and initiatives.
2) Blocking out two housing blocks as a *Prototype City* to get more real world data.
3) Creating a *Model City* scaled to replicate a major city to synthesize translatable data.
4) Creating forced adoption through government intervention (no incentives).

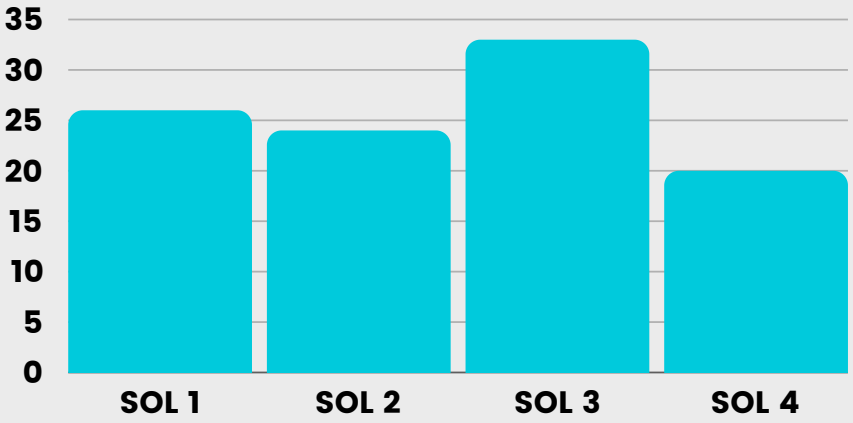

Figure One: Each Solution Plotted

Based on the decision matrix formed, Solution 3: Testing in a Model City, is the best option.

Please refer to the appendix for a breakdown of how these figures were calculated.

Disengagements are affecting the lowest level of autonomy and as such, this challenge must be addressed first. Additionally, this challenge is mostly addressed through the implementation of a system to enable real life data gathering. In addressing this, automotive manufacturers must ensure public safety. After assessing all solutions proposed, Solution 3: testing in a model city, is identified as the best option.
This solution not only promotes an environment where real life data can be gathered safely, it seems promising in revolutionizing the industry as a whole.

Implications

- **Lack of Real World Data** - Provides a system geared towards effective data gathering.
- **Public Concern for Safety**- Provides peace of mind for the public as testing poses no threats.
- **Topic Controversy** - Aids in shaping better systems to eventually combat controversy.

CONCLUSION

Having reviewed the problems presently challenging the adoption of autonomous vehicles, it is discovered that the most impactful is the lack of real world data. This problem is paradoxical in nature as its solution depends solely on the adoption and use of this technology. Following from this realization, Stellar has presented four possible solutions to decrease the barrier between the present state and the state of adoption. Through the use of strategic decision assessment, the optimal solution is highlighted.

The creation of a model city which is made to scale of any major city, would create safety, efficiency, and streamline the process of gathering real world data. The employment of this strategy can also be a step in revolutionizing the testing process for similar future technologies.

Main Problem

- Lack of real world data.

Possible Solutions:

- Incentivized Adoption.
- Creating a Prototype City.
- Creating a Model City.
- Forced Adoption.

Optimum Soltuion:

- Creating a Model City.

Autonomous Vehicles are a technology, the correct implementation of which pose a serious benefit to society. The successful adoption of this technology can translate to the preservation of over one million lives annually. After assessing this prospective technology and its developments thus far, we believe this technology is extremely feasible as the problems preventing its adoption are, by nature, curable. With the correct due diligence and solution implementation, Stellar believes the adoption of EVs are inevitable.

REFERENCES

[1] F. FavarÃ², S. Eurich, and N. Nader, “Autonomous vehicles’ disengagements: Trends, triggers, and regulatory limitations,” Accident Analysis & Prevention, vol. 110, pp. 136â€“148, Jan. 2018. doi:10.1016/j.aap.2017.11.001

[2] A. Taeihagh and H. S. Lim, “Governing Autonomous Vehicles: Emerging Responses for safety, liability, privacy, cybersecurity, and industry risks,” Transport Reviews, vol. 39, no. 1, pp. 103â€“128, Jul. 2018. doi:10.1080/01441647.2018.1494640

[3] P. Kopelias, E. Demiridi, K. Vogiatzis, A. Skabardonis, and V. Zafiropoulou, “Connected & Autonomous Vehicles â€“ Environmental Impacts â€“ a review,” Science of The Total Environment, vol. 712, p. 135237, Apr. 2020. doi:10.1016/j.scitotenv.2019.135237

[4] R. M. Gandia et al., “Autonomous vehicles: Scientometric and Bibliometric Review,” Transport Reviews, vol. 39, no. 1, pp. 9â€“28, Sep. 2018. doi:10.1080/01441647.2018.1518937

[5] K. Bimbraw, "Autonomous cars: Past, present and future a review of the developments in the last century, the present scenario and the expected future of autonomous vehicle technology," 2015 12th International Conference on Informatics in Control, Automation and Robotics (ICINCO), Colmar, France, 2015, pp. 191-198.

[6] J. Van Brummelen, M. O’Brien, D. Gruyer, and H. Najjaran, “Autonomous Vehicle Perception: The technology of today and Tomorrow,” Transportation Research Part C: Emerging Technologies, vol. 89, pp. 384â€“406, Mar. 2018. doi:10.1016/j.trc.2018.02.012

[7] D. Parekh et al., “A review on Autonomous Vehicles: Progress, methods and challenges,” Electronics, vol. 11, no. 14, p. 2162, Jul. 2022. doi:10.3390/electronics11142162

[8] A. Faisal, T. Yigitcanlar, Md. Kamruzzaman, and G. Currie, “Understanding autonomous vehicles: A systematic literature review on capability, impact, planning and policy,” Journal of Transport and Land Use, vol. 12, no. 1, Jan. 2019. doi:10.5198/jtlu.2019.1405

APPENDIX

Solution Assessment Template	
Cost	(10 = Lowest Cost)
Safety	(10 = Safest)
Efficiency	(10 = Most Efficient)
Feasibility	(10 = Safest)

Table 1: Solution Assessment Template

Incentivized Adoption	
Cost	6
Safety	6
Efficiency	8
Feasibility	6

Table 2: Incentivized Adoption Assessment

Prototype City	
Cost	2
Safety	9
Efficiency	9
Feasibility	4

Table 3: Prototype City Assessment

Model City	
Cost	7
Safety	10
Efficiency	8
Feasibility	8

Table 4: Model City Assessment

Forced Adoption	
Cost	8
Safety	1
Efficiency	9
Feasibility	2

Table 5: Forced Adoption Assessment