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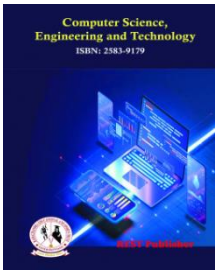

Corridor Selection for Autonomous Vehicle Deployment

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Abstract: *Introduction: Corridor selection plays a critical role in determining the optimal locations for deploying autonomous vehicles. With the rapid advancement of self-driving technology, identifying suitable corridors becomes paramount to maximize the efficiency, safety, and overall performance of autonomous vehicle systems. The process involves analyzing various factors such as traffic patterns, infrastructure conditions, regulatory frameworks, and user preferences. This paper explores the significance of corridor selection and highlights the key considerations involved, shedding light on the crucial decision-making process for locating autonomous vehicles in the most favorable corridors. The research on corridor selection for locating autonomous vehicles holds significant importance in the field of transportation and autonomous systems. It addresses the need to identify the most suitable corridors for deploying self-driving vehicles, taking into account factors such as traffic flow, infrastructure conditions, and regulatory aspects. The outcomes of this research can inform policymakers, urban planners, and transportation companies in making informed decisions regarding the placement of autonomous vehicles, ultimately leading to optimized traffic management, enhanced mobility, and improved safety on roadways. The methodology for studying the supplier selection process in the dairy industry will involve a combination of qualitative and quantitative approaches. Firstly, a comprehensive literature review will be conducted to gather insights into the existing supplier selection criteria and methodologies used in the industry. This will be followed by qualitative interviews and surveys with key stakeholders such as dairy company managers, procurement professionals, and suppliers to gather their perspectives on the supplier selection process. To find recurring themes and patterns in the acquired data, qualitative data analysis approaches will be used. Additionally, using statistical techniques and models like the Analytic Hierarchy Process (AHP) and TOPSIS, quantitative analysis will be done to assess the significance and effectiveness of various supplier selection criteria. To provide a comprehensive understanding of the supplier selection procedure in the dairy business, the results from both qualitative and quantitative assessments will be merged. road space availability, separation from car traffic, keeping pedestrians apart, number of travellers, possibility for revenue. road space availability, separation from car traffic, keeping pedestrians apart, number of travellers, Income potential from the result the availability of road has secured the first place and segregation from pedestrians stays at the least. availability of road plays an important role in building corridor selection for locating autonomous vehicles.*

Keywords: *First, second, and third order repercussions of automated driving on society and policy are discussed.*

1. INTRODUCTION

Through the technological advancements they offer, autonomous vehicles (AVs) give fresh perspectives on mobility (Howard and Dai 2014). They provide a wide range of advantages in terms of convenience, environmental impact, safety, and efficacy. The reduction of a car accident's human causes is one of AVs' main advantages. Benefits of efficiency include improved traffic flow management, which results in less traffic congestion. Additionally, AVs give the weaker demographics—the old, children, and the disabled—more mobility.[1] In order to accomplish safe and enjoyable autonomous driving, it is important to be able to handle a variety of different driving situations, such as parking and negotiating difficult road conditions. Prioritizing traffic safety and increasing passenger comfort are the main objectives. Model predictive control (MPC), which enables the systematic incorporation of system restrictions and nonlinearities, is one potential control approach that is ideally suited for this goal. Adaptive cruise control (ACC) can be utilized as a solution to reduce rear-end incidents, which are frequently brought on by inadequate following distances, driver distraction, and sudden traffic halts.[2]

MPC has been used in a number of research papers in the past for autonomous vehicle motion control and trajectory planning, for example particular optimal control trajectory planning algorithm frequently assumes a given reference trajectory or takes into account either the longitudinal or the lateral aspects of the trajectory planning problem, which can be concluded, in order to reduce the computational complexity caused, for example, by vehicle dynamics and collision avoidance constraints[3]. In the context of highly automated driving, the driver transfers control to the vehicle for a specific period, resulting in the driver being temporarily disengaged from the driving process. Consequently, the driver may not actively monitor the system (Gasser et al., 2012). This shift in responsibility necessitates a change in research focus from a scenario where the driver is actively involved ("driver in-the-loop"), with concerns such as driver distraction and multitasking, to a scenario where the driver is temporarily disengaged ("driver out-of-the-loop"). In the latter scenario, the driver must be prepared to resume control when system limitations arise.[4] It is possible to use incomplete observations of vehicle trajectories in order to estimate time-varying origin-destination (OD) matrices from time-series of traffic counts. They may come from floating automobile data as well as automated vehicle identification (AVI) methods like automatic license plate recognition. The core description of the problem permits the use of information from induction loops and AVI equipment at random (but fixed) points in the network, as well as the presence of mistakes in all traffic counts and less than ideal recognition rates at the AVI-stations [5]. Prioritizing the capabilities of the vehicle is essential when creating algorithms for motion control. Although there has been a lot of research on trajectory tracking and motion planning for robots and unmanned aerial vehicles, it is still difficult to effectively plan and execute vehicle motion because of inadequate consideration of the vehicle's dynamic capabilities and the variability of environmental factors. The ability of a vehicle to move is affected by both external factors and its own dynamic capabilities, which include stability requirements, electrical control system characteristics, and the tire/road interaction's ability to adhere, which varies dynamically on different road surfaces.[6]. The choice of an appropriate fitness function is crucial to the solution of the shape identification and position/orientation detection problem. The specific object model used in this investigation determines how well the fitness function performs. We will contrast its detection results with those obtained using a surface model-based fitness function in order to assess the effectiveness of target detection using the surface-strips model-based fitness function The processing tasks of Advanced Driver Assistance Systems (ADAS) for passenger cars can be summed up as follows. This section gives descriptions of both models Although having a complete grasp of the entire traffic scene is still a distant goal [1], there are some specialized systems, such lane keeping assistance, that are already a standard part of ADAS and are present in the majority of new car models. Although these devices are now available for purchase [2], they are less useful for motorways and other comparable road types because their usefulness is mostly restricted to well-defined roads with mild curves.[8] More than 41,000 people lost their lives and an additional 2.5 million people were injured in car accidents in the United States in 2007, according to statistics on traffic safety provided by the National Highway Traffic and Safety Administration (NHTSA)..

2. MATERIALS & METHODOLOGY

It is suggested that the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method be expanded with fuzzy logic in order to overcome the drawbacks of utilizing crisp values in decision-making and to better handle the fuzziness and imprecision of real-world problems. A powerful method for acquiring group knowledge and using a causal diagram to visualize causal linkages between sub-systems is the DEMATEL method. But when it comes to making decisions, human assessments of preferences are frequently ambiguous and challenging to describe properly using numerical numbers. A relevant framework for dealing with issues marked by ambiguity and imprecision is provided by fuzzy logic. By incorporating fuzzy logic into the DEMATEL method, decision-makers can make more informed and effective decisions in fuzzy environments. This extension allows for a more flexible representation of preferences and provides a better understanding of the interrelationships among sub-systems. By combining the strengths of the DEMATEL method and fuzzy logic, decision-makers can overcome the limitations of crisp values and better capture the complexities and uncertainties inherent in real-world decision-making scenarios.[1] A second questionnaire was created and sent to the hospital management in order to meet the DEMATEL method's goal of identifying the critical success criteria for raising the general level of medical care service quality at Show Chwan Memorial Hospital. The questionnaire had two goals: first, it was used to rank the significance of the specified criteria, and second, it was used to establish the causal connections between them. The DEMATEL technique and input from the management allowed the major success elements for improving the quality of medical care services to be determined. The DEMATEL method enables the visualization of causal relationships among criteria through a causal diagram. By understanding the causal relationships among the identified key success factors, the hospital management can gain insights into how changes or improvements in one factor may impact others. This knowledge facilitates decision-making and the formulation of strategies to improve the overall medical care service quality. Through the application of the DEMATEL method and the analysis of causal relationships, Show Chwan Memorial Hospital can identify areas of improvement and take appropriate actions to enhance their medical care service quality based on the prioritized key success factors.[2]

Although DEMATEL has been successfully used to address a variety of real-world issues in a variety of sectors, the paper acknowledges that current approaches have limits when it comes to complicated systems with a large number of variables. Due to societal and economic progress, it is becoming more and more crucial to handle the complexity of factor analysis problems in these systems. The goal of this study is to offer a hierarchical DEMATEL method that is targeted at the challenge of critical factor identification in complex systems. Complex systems, as referred to in the paper, are characterized by a large number of factors, multiple types of influences, and the presence of a hierarchy. By establishing a hierarchical DEMATEL method, the paper aims to provide a solution for effectively analyzing and identifying critical factors in complex systems. By taking into account the hierarchical structure that complex systems have, this approach will allow for a clearer understanding of the connections and interactions between various components. The proposed method is expected to contribute to the advancement of factor analysis in complex systems and provide insights for decision-making and problem-solving in various domains.[3] A new approach based on DEMATEL (Decision Making Trial and Evaluation Laboratory) is suggested in this work to change the data model. DEMATEL is renowned for its ability to analyses both direct and indirect links between system elements while taking into account the nature and gravity of these linkages. By applying DEMATEL to the analysis of the total relationships among system components, a better understanding of the structural relationships and an ideal approach to solving complex system problems can be achieved. The key idea behind using DEMATEL in this study is to deal with a large amount of interrelated evidence, which forms a complex system. DEMATEL helps identify the negative or detrimental information within this complex system. The basic steps of the DEMATEL method involve generating a total-relation matrix based on the similarity of evidence. By utilizing this modified DEMATEL method, the study aims to provide insights into the relationships among system components and identify key factors that contribute to system performance or problems. This approach can assist in decision-making processes and provide a systematic way to address complex system issues.[4] The fuzzy decision-making trial and evaluation laboratory (DEMATEL) method is utilized in this study to choose appropriate suppliers for businesses. This study makes a unique addition by using the DEMATEL approach to determine the relationship between variables that can impact supply chain management (SCM) performance. The DEMATEL approach has the benefit of revealing the connections between different criteria and how they affect one another during the supplier selection process. This study uses the fuzzy DEMATEL approach to discover the direct and indirect influences among supplier selection criteria. The supplier selection criteria' causal linkages and the strength of those associations are calculated. The DEMATEL technique has the benefit of not requiring a lot of data, which makes it a practical method for analyzing complicated systems. The overall goal of this study, which employs the fuzzy DEMATEL method, is to improve knowledge of the interactions between supplier selection criteria and offer insightful information that will help businesses choose suppliers wisely in the context of supply chain management. [5.] Determining the causes and consequences of relationships among components in a complex system is in reality a task that the DEMATEL approach is well equipped for. It is efficient at spotting the connections between these elements and creating a thorough map that depicts their interrelationships. This map offers insightful information and assists in resolving challenging decision-making issues. The capacity of DEMATEL to divide interdependency interactions between elements into two distinct groups—cause and effect—is one of its main advantages. This categorization helps in understanding the causal relationships and the impact each factor has on others. By analyzing the influential relation map generated by DEMATEL, it becomes possible to identify critical factors within the complex structural system. In summary, DEMATEL is a powerful tool for studying the relationships between factors and determining their significance in a complex system. Its ability to uncover interdependencies and identify critical factors contributes to more informed decision-making processes.[6] The Science and Human Affairs Programmed of the Battelle Memorial Institute of Geneva created the Decision-making Trial and Evaluation Laboratory (DEMATEL) technique in its basic form between 1972 and 1976. It was intended to address complex and interwoven problem groups. Since its creation, DEMATEL has been widely used in a variety of industries. DEMATEL has been used in a variety of fields, such as aviation safety management, emergency management, the effects of web advertising, auditing, and risk management in corporate resource planning. Evaluation of entwined effects in e-learning programmers, identification of critical hospital service success factors, performance standards for employment service outreach programmers, choice of cost of quality models, selection of mobile banking system service, assessment of failure risk, and identification of critical factors in the auto spare parts industry are just a few examples. The DEMATEL method's capacity to recognize interconnectedness among system components is one of its key features. It achieves this by using a causal diagram to show the relationships between the parts in context. The hierarchical structure of DEMATEL allows for a clear understanding of the strength of influence between elements. In summary, DEMATEL is a powerful method for analyzing complex systems and understanding the interdependencies and strengths of influence among their elements. Its applications have been wide-ranging and have contributed to decision-making processes in various domains.[7] Indeed, when implementing the DEMATEL approach to identify Critical Success Factors (CSFs), the degree of direct influence between each pair of elements needs to be determined. Typically, these degree scores are obtained through expert surveys. However, human judgment in decision-making is often subjective and can be challenging to express

precisely with numerical values. This is where fuzzy logic comes into play. Fuzzy logic is a valuable tool for handling problems that involve vagueness and imprecision. It allows for the representation and manipulation of uncertain or subjective information. By incorporating fuzzy logic into the DEMATEL method, better decisions can be made in fuzzy or uncertain environments. Fuzzy logic enables a more nuanced and flexible representation of the relationships between elements, taking into account the inherent uncertainties and ambiguities in human judgment. Extending the DEMATEL method with fuzzy logic enhances its capability to deal with the inherent fuzziness in decision-making processes. It allows for a more accurate and realistic representation of the interdependencies and influences among elements, leading to better-informed decisions in complex and uncertain situations.[8] Between 1972 and 1976, the Science and Human Affairs Programmed of the Battelle Memorial Institute in Geneva created the Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique with the aim of investigating and resolving complex and interwoven problem groups.

Alternative and evaluative parameters

1. number of passengers: The number of passengers is a crucial factor in transportation planning, as it helps determine capacity requirements and influences the overall comfort and experience of travelers. Proper consideration of passenger numbers is essential for efficient and satisfactory transportation services.

2. Revenue potential: Revenue potential is an important aspect to consider in various industries, including transportation. Assessing the revenue potential helps identify the profitability of a particular corridor or route, enabling businesses to allocate resources effectively and make informed decisions regarding investment and pricing strategies

3. Segregation from vehicle traffic: Segregation from vehicle traffic is a key consideration in corridor selection for autonomous vehicles. Creating dedicated lanes or routes that are separate from regular vehicle traffic helps ensure the safety and efficiency of autonomous vehicle operations. It reduces the risk of collisions and allows for smoother traffic flow, improving overall transportation experience**.**

4. Segregation from pedestrians: Segregation from pedestrians is crucial in corridor selection for safety and efficient transportation. Designing dedicated paths or infrastructure that separates autonomous vehicles from pedestrians minimizes the risk of accidents, ensures pedestrian comfort, and promotes a smooth flow of both vehicular and pedestrian traffic.

5. Availability of road space: The availability of road space is a crucial factor in corridor selection for locating autonomous vehicles. Sufficient road space is necessary to accommodate the increased presence of autonomous vehicles without causing congestion or compromising the flow of regular traffic. Adequate road space ensures efficient and safe operations of autonomous vehicles in the selected corridors.

3. RESULTS & DISCUSSION

TABLE 1. Evaluation factors

	Availability of road space	Segregation from veh	Segregation fr	Number of passer	Revenue potenti	SUM
Availability of road spa	0	3	3	4	5	15
Segregation from vehi	3	0	4	2	1	10
Segregation from ped	2	5	0	3	3	13
Number of passenger	4	3	2	0	3	12
Revenue potential	1	3	2	5	0	11

TABLE 1 shows DEMATEL method and evaluation factors availability of road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, income potential.

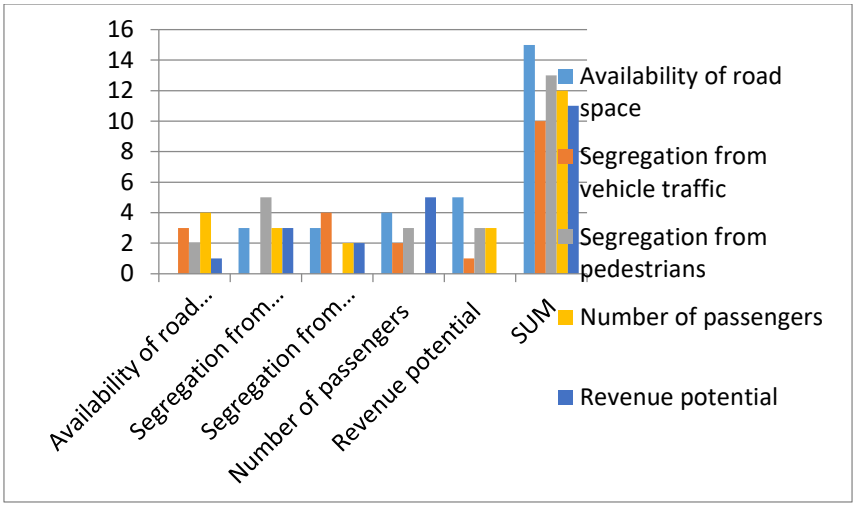

FIGURE 1. Evaluation factors

FIGURE 1 SHOWS DEMETAL METHOD and evaluation parameters availability of road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, income potential.

TABLE 2. Normalization of direct relation matrix method

	Availability of road space	Segregation from vehicle traffic	Segregation from pedestrians	Number of passengers	Revenue potential
Availability of road space	0	0.2	0.2	0.266666667	0.333333333
Segregation from vehicle traffic	0.2	0	0.266666667	0.133333333	0.066666667
Segregation from pedestrians	0.133333333	0.333333333	0	0.2	0.2
Number of passengers	0.266666667	0.2	0.133333333	0	0.2
Revenue potential	0.066666667	0.2	0.133333333	0.333333333	0

The normalization of the direct relation matrix method and the evaluation criteria (availability of road space, separation from vehicle traffic, separation from pedestrians, number of passengers, and revenue potential) are shown in TABLE 2.

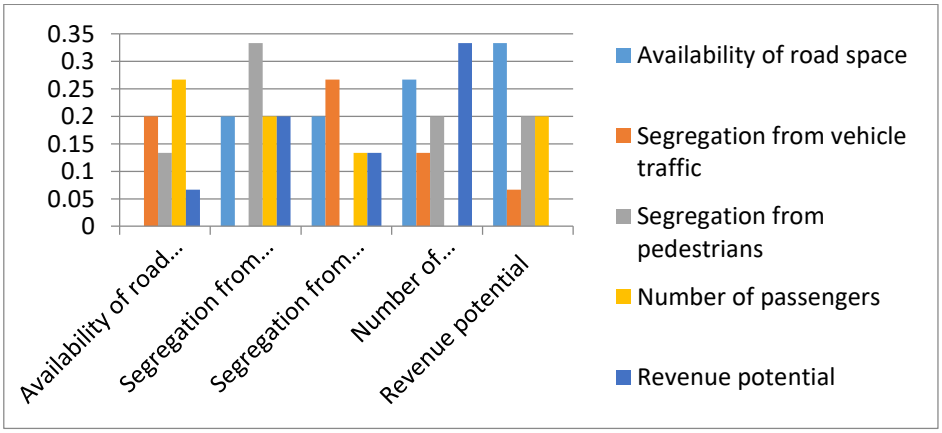

FIGURE 2. Normalization of direct relation matrix METHOD

The evaluation parameters available road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, and income potential are shown in FIGURE 2 after normalizing the direct relation matrix METHOD.

TABLE 3. Total relation matrix method

	Availability of road space	Segregation from vehicle traffic	Segregation from pedestrians	Number of passengers	Revenue potential
Availability of road space	0.718296193	1.0941183	0.9292338	1.1433493	1.0602232
Segregation from vehicle traffic	0.695631081	0.6887479	0.7820782	0.7864739	0.6581706
Segregation from pedestrians	0.751260077	1.0718472	0.6776611	0.9620544	0.8498196
Number of passengers	0.823152863	0.9462302	0.767475	0.7815931	0.8472799
Revenue potential	0.628231594	0.8690138	0.6978777	0.9556563	0.5980516
Ci	**3.616571808**	**4.669957**	**3.854326**	**4.629127**	**4.013545**

Table 3: Total Relation Matrix Method and Evaluation Parameters for Selecting Third-Party Logistics Providers. The table illustrates the availability of road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, and revenue potential as evaluation parameters for selecting third-party logistics providers.

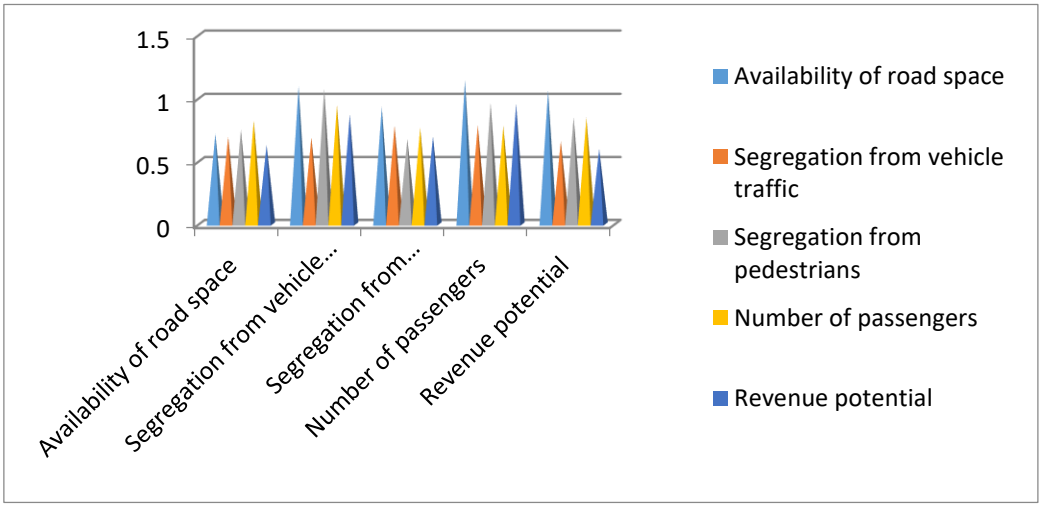

FIGURE 3. Total relation matrix method

Figure 3: Total Relation Matrix Method and Evaluation Parameters for Selecting Third-Party Logistics Providers. The figure depicts the availability of road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, and revenue potential as evaluation parameters for selecting third-party logistics providers.

TABLE 4. Calculation of Ri+Ci and Ri-Ci to get the cause and effect

	Ri+Ci	Ri-Ci	Rank	Identity
Availability of road space	8.5617926	1.328649	2	cause
Segregation from vehicle traffic	8.2810591	-1.0588557	3	effect
Segregation from pedestrians	8.1669684	0.4583165	4	effect
Number of passengers	8.7948581	-0.4633959	1	effect
Revenue potential	7.7623761	-0.2647139	5	cause

Table 4: DEMATEL Method and Identity Matrix for Evaluation Parameters in Selecting Third-Party Logistics Providers. Table 4 displays the DEMATEL method and identity matrix for evaluating the parameters of availability of road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, and revenue potential in the selection process of third-party logistics providers.

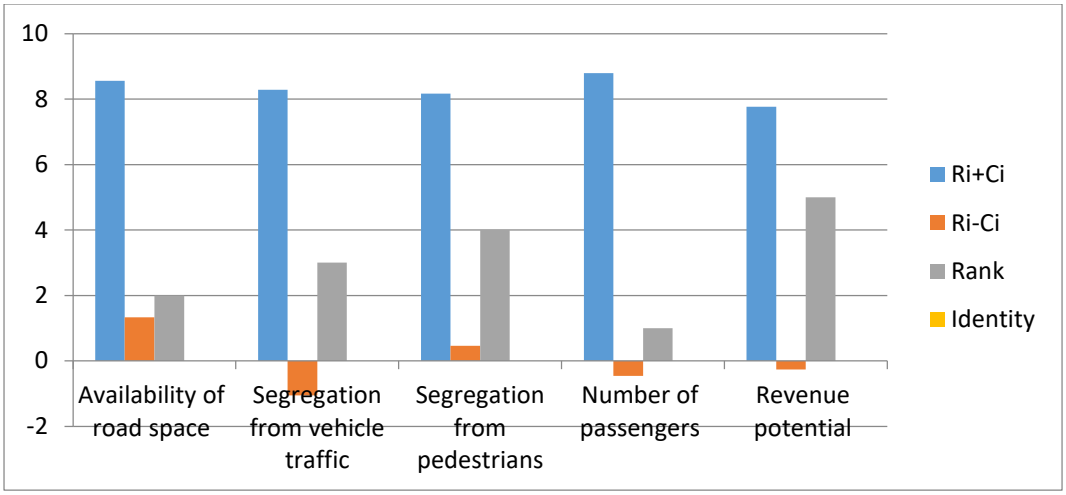

FIGURE 4. Calculation of Ri+Ci and Ri-Ci to get the cause and effect

Figure 4: Identity Matrix for Evaluation Parameters in Selecting Third-Party Logistics Providers. Figure 4 illustrates the identity matrix for evaluating the parameters of availability of road space, segregation from vehicle traffic, segregation from pedestrians, number of passengers, and revenue potential in the selection process of third-party logistics providers.

TABLE 5. Rank of the characteristics

	Rank
Availability of road space	1
Segregation from vehicle traffic	2
Segregation from pedestrians	5
Number of passengers	4
Revenue potential	3

TABLE 5 shows rank of the characteristics where availability of road stands on the top and segregation from pedestrians be the least.

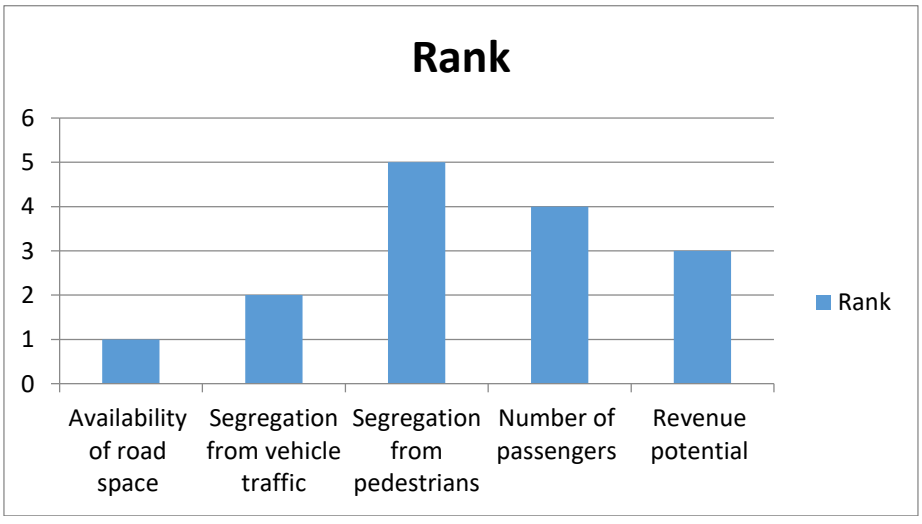

TABLE 5. Rank of the characteristics

Figure 5 shows rank of the characteristics where availability of road stands on the top and segregation from pedestrians be the least.

4. CONCLUSION

In conclusion, corridor selection plays a crucial role in determining the optimal locations for deploying autonomous vehicles (AVs) and ensuring their safe and efficient operation. Through this process, several key factors need to be carefully considered to achieve the desired outcomes. Firstly, the physical characteristics of the corridors, such as road conditions, traffic flow, and infrastructure, significantly impact the performance of AVs. Selecting corridors with well-maintained roads, appropriate signage, and sufficient supporting infrastructure, including charging stations and communication networks, is essential to facilitate the smooth operation of AVs. Secondly, the corridor selection process should consider the specific operational requirements and objectives of AVs. Factors such as the desired travel speed, maximum capacity, and potential interactions with pedestrians and other vehicles must be taken into account. Additionally, the availability of dedicated lanes or exclusive rights-of-way can enhance the safety and efficiency of AV operations. Furthermore, corridor selection should also consider the surrounding environment and its compatibility with AV technology. Urban areas with high population densities and complex road networks may pose more challenges for AV deployment, whereas less congested suburban or rural corridors may offer more favorable conditions. Evaluating the surrounding land use patterns, parking availability, and potential integration with existing transportation systems can contribute to a seamless integration of AVs into the selected corridors. Overall, the corridor selection process for locating autonomous vehicles requires a comprehensive assessment of various factors, including physical characteristics, operational requirements, and environmental considerations. By carefully considering these factors, stakeholders can identify corridors that offer the most favorable conditions for the safe and efficient deployment of AVs, contributing to the advancement of sustainable and intelligent transportation systems.

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