Journal for Re Attach Therapy and Developmental Diversities
eISSN: 2589-7799
2023September; 6(9s): 1901-1910

Review of Dynamic Decision Making ForConnected VehiclesIn IotSystem

Miss. Sonal Sanjay Ayare[1*], Dr. Suraj V. Pote[2], Dr. Jaydeep B. Patil[3]

[1a] Research Scholar – Computer Engineering, University Of Technology, Jaipur, Rajasthan.
[1b]Assistant Professor, Computer Science Engineering, Kolhapur Institute of Technology's College Of Engineering, Kolhapur. email-sonala936@gmail.com
[2]Professor, Computer Engineering, University Of Technology, Jaipur, Rajasthan. email-potesuraj@gmail.com
[3]Associate Professor, Associate Dean Academics, Ph.D. Guide at D Y Patil Agriculture and Technical University, Talsande, Kolhapur ,Maharashtra . email-er.jaydeep7576@gmail.com

ABSTRACT

By leveraging real-time data and sophisticated algorithms, dynamic decision-making for connected vehicles elevates safety and efficiency to the level of a paradigm shift in transportation technology. This article examines the present state of dynamic decision-making, emphasizing the possible advantages and difficulties it may present. The utilisation of critical elements including data analytics, machine learning, and artificial intelligence empowers interconnected vehicles to accurately and promptly traverse intricate surroundings. However, widespread adoption is hindered by infrastructure integration, cybersecurity vulnerabilities, and public acceptability, all of which pose substantial obstacles. The prospective advantages, such as decreased accidents, alleviated traffic congestion, and enhanced mobility, emphasize the criticality of confronting these obstacles. In the future, the potential for dynamic decision-making in connected vehicles is contingent upon connectivity advancements, including the integration of autonomous features and 5G technology. These advancements hold the potential to revolutionize transport within smart cities by streamlining traffic circulation and delivering customized experiences. Sustained investigation, stakeholder collaboration, and the establishment of regulatory frameworks are imperative in order to fully harness the capabilities of dynamic decision-making in connected vehicles.

Keywords: dynamic decision-making, connected vehicles, artificial intelligence, machine learning, data analytics, cybersecurity, infrastructure integration, public acceptance, 5G connectivity, autonomous features, smart cities, transportation technology.

Introduction

To cater ever growing demands for transportation around the globe as population goes on increasing every day, number of vehicles plying on roads had risen rapidly. Due this growing number of moving machines deaths and fatal injuries increases as a result of road accidents. Preventing accident can be achieved by implementing adopting Internet of Things (IoT), connecting vehicles are transformed into smart vehicle monitoring system. In this detailed study research, we undertake investigation of intelligent traffic system in a distributed environment by penetrating intelligence into connected automobiles in terms of dynamic decision making for passing through a certain location like roundabout, and intersection. Specifically, we have suggested a model for next generation of Intelligent Transportation System (ITS) which depends on optimization in ant colony, a typical Swarm Intelligence (SI)-based algorithm. We first present an infrastructure of communication between connected vehicles for exchange of information on traffic flowing on roads. Implementing idea of SI later, linked automobiles were considered as artificial ants that are self-reliant in calculating to take an adaptive decision based on current random situation of traffic flowing on junctions. For checking robustness and dynamism of suggested concept we have design and calibrated a system of modelling and simulating traffic system applying IoT atmosphere. This investigation concentrates on, storing IoT, analyzing and data transporting to cloud platform. Meanwhile with rapid growth in number of IoT based application there is tremendous growth in related data on clouds. It is desirable to minimize this IoT data processing managing to decentralize and distributed systems. Concerning this we implemented SI in IoT processing of data to be quicker and most efficient. Algorithms like Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), and Artificial Bee Colony (ABC) are all SI based. These algorithms are self-organized and decentralized in terms of incomplete information, limited computation capabilities and dynamic properties in solving complicated issues which is critical problem related to IoT system. In IoT processing currently, many applications of SI have been implanted such as cloud computing of data optimization, connected vehicles, and data routing. This research work focuses on applying for Transportation management in IoT system is implemented with SI-based algorithm forms the underlying concept of research. We suggested a novel approach for next generation of ITS, depending on sharing of information amongst devices in an area under research. With this vehicle are capable to adaptively as well automatically finds best trails from source to destinations. Detailed report is made about transportation system based on advanced vehicular technologies in which connections of physical objects can be characterized in cyber entities. Connected vehicles are armed with access to Internet enabling vehicles to receive and transmit data with outer and inner peripherals of systems like Vehicle-to-Infrastructure (V2I), Vehicle to-Vehicle (V2V), Vehicle-to-Base Station (V2B) and Vehicle-to- Sensor (V2S) –. To provide intelligent services in transportation management based on nature-inspired intelligent swarm technologies, is an aim current research in which

1.1 BRIEF HISTORY OF CAV

CAV are also called driver-less vehicles. Researchers have been working on this concept since 1920s. General Motor organized an exhibition in 1939 named as New York world's fair to show the world its vision of how the world in the future will look like with CAVs on the road. They showed the concept of an automated intelligent highway system with connected vehicles. This was the first time that a vision of autonomous vehicles was showcased by Norman Bel Geddes [6]. The first autonomous car hit the road few years later where it guided by radio-controlled electromagnetic fields generated with magnetized metal spikes embedded in the roadway. There was slow and gradual progress in this area since then. In the year 2004, DARPA USA started to organize yearly competitions for the development of CAVs known as DARPA grand challenge. In DARPA challenge, students from well-known universities were encouraged to develop CAV for a safer and environment-friendly future. DARPA challenge received great response from students and automobile industry. In another round of the Grand Challenge held On October 8, 2005 in California/Nevada state line the winner developed a robot that was developed for highspeed desert driving without manual intervention. The state of the art artificial intelligence and machine learning technology was used in the vehicular robot's software system [7]. The focus of this challenge was for military applications of autonomous vehicles. However, it created huge interest in big companies like Tesla, Google, General Motors, Ford and others who made huge investments in developing CAVs. In 2014, Tesla showed the world its first ever autopilot car. The Tesla autopilot had features like it could accelerate, steer or brake automatically within its lane, auto park, cruise control, auto lane change. In 2015, Google tested its autonomous car, Firefly on public roads. This car did not use a steering wheel or pedals and was designed to work under 25 miles per hour and was discontinued shortly after its introduction. In 2016, Google introduced Waymo which launched Chrysler Pacifica hybrid minivans in 2017.

1.2 Earlier approaches to the study of dynamic decision making

In Prior Research The concept of dynamic decision making was initially proposed to psychologists in 1962 by Edwards and Toda. Edwards' paper, as noted by Rapoport (1973), was primarily intended to extend SEU theory from static to dynamic problems and to propose the normative-descriptive approach as a general research strategy for its study. Comparing the behavior of actual decision makers to that of the "ideal observer" in psychophysics, this approach entails the construction of a "ideal decision maker" comparable to the "ideal observer." In the event that systematic inconsistencies are identified, they could be construed as indications of the constraints that the actual decision maker was subject to, including memory constraints and difficulties in forecasting the future consequences of one's decisions. Consequently, the human decision maker could be simulated as an instance of constrained optimization. Examples of this are provided by Rapoport (1975) for sequential decision problems. One significant limitation of this methodology is the impossibility of locating analytical solutions for the majority of dynamic decision problems (Rapoport 1975). The 'flat maximum problem' is an additional issue that Rapoport (1973) also examines. That is to say, substantial deviations from the optimal strategy yield negligible impacts on the decision outcomes in numerous dynamic problems. As a result, identifying the constraints that this strategy imposes on the decision maker is challenging. Hence, the lack of widespread adoption of the normative-descriptive approach among scholars investigating dynamic decision making, in contrast to its popularity among those examining static problems, is to be expected. "The Fungus Eater," a one-person game introduced in Toda's (1962) paper, served as a paradigm for the study of dynamic decision making. Nevertheless, analytical solutions were only discernible for exceedingly simplified iterations of the game, thereby preventing the complete realization of its empirical potential. Nonetheless, the overarching strategy of developing a computer simulation as a tool for investigating dynamic decision making proved to be foresighted. Following that, the majority of subsequent analyses of dynamic decision making have shifted their focus from normative aspirations to empirical research. Before proceeding to an analysis of these findings, a general framework for the study of dynamic decision making will be presented.
https://sci-hub.53yu.com/10.1016/0001-6918(92)90019-a

1.3 COMPUTER-SIMULATED MICROWORLDS: A RESEARCH PARADIGM FOR THE STUDY OF DYNAMIC DECISION MAKING.

Regarding the survey, it is possible to conduct field research on dynamic decision making; nevertheless, this approach is not viable for the vast majority of dynamic systems that exist beyond the confines of the laboratory. In order to investigate the cognitive frameworks of process operators, for example, a researcher might dedicate a number of months to becoming an expert on the process for which the operator is assumed to have a mental model. Moreover, in spite of understanding the methodology, gathering data is a challenging endeavour that often requires an experimental intervention to produce significant findings. The lack of a theoretical framework concerning dynamic decision making in the realm of field research is therefore not unexpected. Therefore, it is crucial to integrate laboratory-oriented methodologies into field research. The subsequent sections of this paper will consist of an examination of the results obtained by applying a number of these approaches. As previously mentioned, dynamic decision problems are characterized by a real-time state transition, which occurs both autonomously and in reaction to the decision maker's actions. Additionally, these issues necessitate the immediate implementation of decisions. Depicting these attributes through conventional paper-and-pencil experiments is not feasible. As a result, laboratory inquiries concerning dynamic decision making were compelled to foresee the introduction of a revolutionary research tool: the laboratory computer. The investigation of subject interaction with dynamic simulations and the development of such simulations are both made possible through the use of laboratory computers. They are referred to as "microworlds" in the field of simulation. Although microworlds do not replicate every intricate detail, they do replicate certain critical attributes that are inherent to dynamic systems. The subject is entrusted with the responsibility of regulating a "wood cut" (Holzschnitt) of a given system, which may include a forest fire, industrial process, small town, burgeoning nation, or industrial facility, for a predetermined period of time. 0001-69182990019-a.pdf

As a key component of the automated intersection management system, decision-making and planning of vehicles becomes one of the major tasks to be solved [26]. For example, rule-based decision-making approaches are commonly used in autonomous driving. However, such rule-based approaches are reliable and easy to interpret. For simple driving scenarios, it can achieve a good performance on safety with hand-engineered rules. But when dealing with complex urban environments, such as road intersections, where various uncertainties exist, a rule-based approach cannot maintain safe and efficient driving.

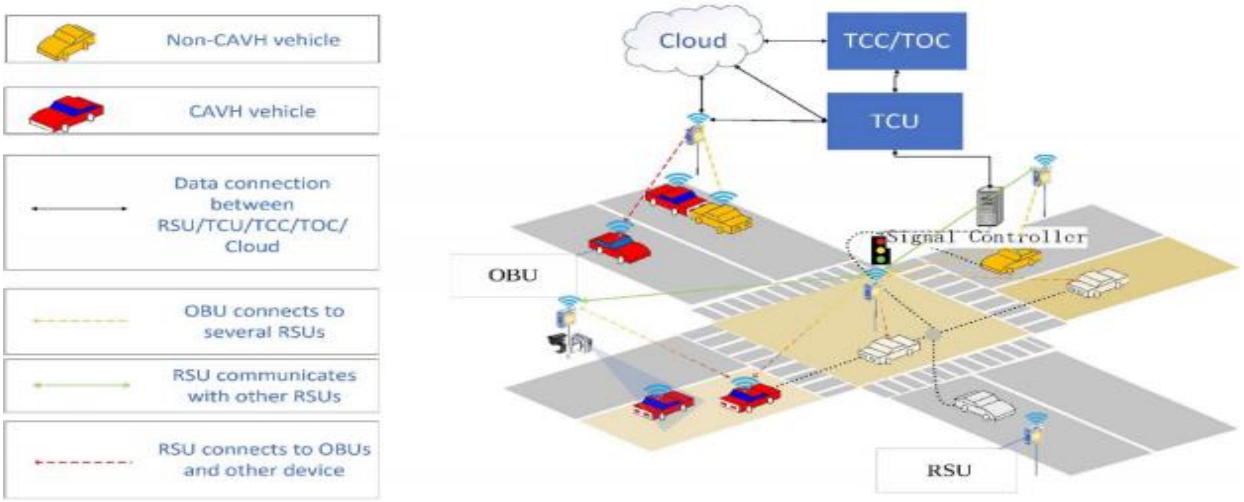

Figure 1 A typical complete AIM system
s10033-021-00639-3.pdf

As illustrated in Figure 2, the prior research concentrated primarily on planning and decision-making technologies at road intersections. In the first place, we classify the general planning and decision-making technologies at intersections described in the previous paper into the following four main approaches: machine learning-based, prediction-based, and graph-based. We concluded with a summary of the ten technologies utilized in a cooperative vehicle infrastructure environment. Considering both signalised and unsignalized intersections, mixed and exclusively automated driving traffic are analyzed. It is our conviction that the insights gained from examining existing strategies, protocols, and simulation tools can assist scholars in recognizing the obstacles faced by the proposed methodologies and pinpointing the unresolved concerns that warrant further investigation. The subsequent sections of this paper are structured as follows: The general technologies utilized for planning and decision-making at intersections are introduced in Section 2. We demonstrate the Vehicle-Infrastructure Cooperation control method for intersections in Section 3. We also elaborate on the effects of wireless communication technologies in this section. Comparing the ten current state-of-the-art in a mixed-traffic environment, the subsequent section 4 analyses their respective performances. In addition, challenges associated with previous approaches and identification of unresolved matters for future research are elaborated upon in Section 5. In finality, this paper is concluded in Section 6.

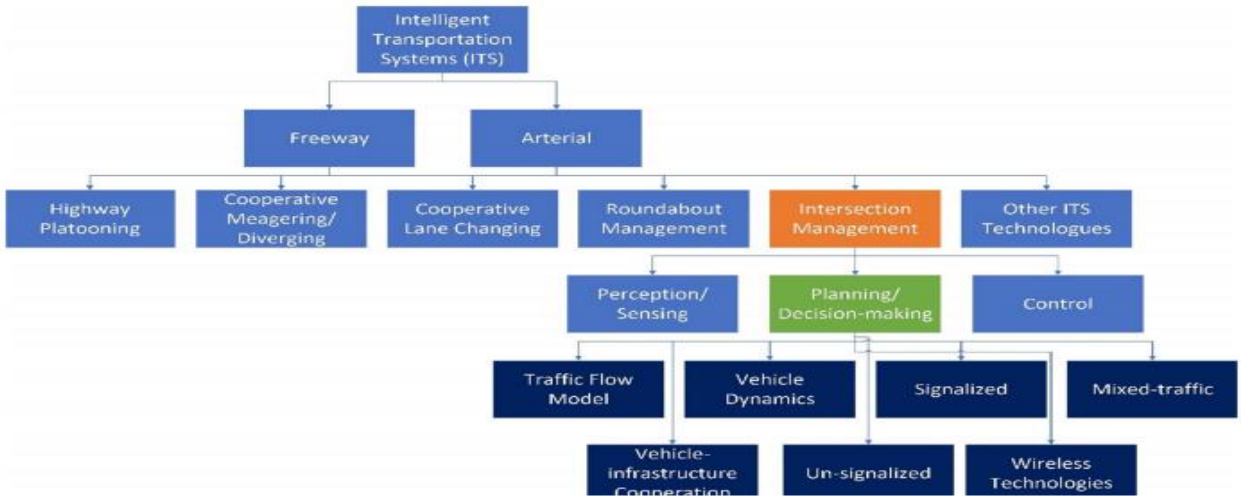

Figure 2 Research scope of this survey
s10033-021-00639-3.pdf

1.4 ANT COLONY OPTIMIZATION (ACO) ALGORITHM

The ACO algorithm in the previous poll was created based on how ants forage in their colonies, where pheromone is the chemical that allows individuals to interact with one another. When an ant finds food, it will return to its colony and scatter some pheromones along the way. The trail with the most pheromone deposits is usually followed by the ants. Moreover, pheromone fades with time. Ants are able to approximate the quickest route to the food source from their nest by laying pheromone and tracking pheromone trails. The ACO method was initially used to solve the job-shop scheduling issue in the literature by Dorigo, Marco, et al. in the 1990s under the name Ant System (AS). ASElite, ASRank, Ant Colony System (ACS), Max-Min Ant System (MMAS), and Best-Worst Ant System (BWAS) are a few of the ACO versions that have been presented since then. In distinct ways, each method improved upon the fundamental algorithm. To update the pheromone, ASElite simply used the optimal solution. Only the subsets of solutions with a ranking system derived from ASRank are considered for the pheromone update. MMAS's pheromone value is limited, and BWAS upgraded the pheromone by using just the best and worst possible options. In ACS, both discovery and extraction methods are used to broaden the range of options for the route selected during the building phase. Furthermore, to diversity the route that succeeding ants created, ACS also used local pheromone updating, which was computed at the conclusion of each ant's building phase. The goal of applying ACS to the job-shop scheduling issue is to reduce tardiness or makespan. This article describes the implementation of ACS to handle the MRO scheduling issue. Figure 3 is a disjunctive graph to define the mathematical model of the ACO algorithm. Each node in the graph represents one operation of the jobs to be scheduled. Two more nodes are added into the graph, representing the starting and ending points. In the algorithm, each ant starts to visit all the nodes one-by-one from the starting node and complete its journey at the ending node. The schedule of the operations to be executed is constructed based on the sequence of the nodes that the ant has visited. All the operations are re-indexed from (0, 1, 2,.., N, N + 1), where 0 and (N+1) are the starting and ending nodes, respectively. The value te is the pheromone on the path that connects nodes rand s. The arrowhead lines indicate the precedence constraints between the operations within the same job. For example, the arrowhead line connecting nodes 1 and 2 indicates that the ant must visit node 1 before it can visit node 2. In other words, the operation O_{11}, must be executed before the operation O_{12}

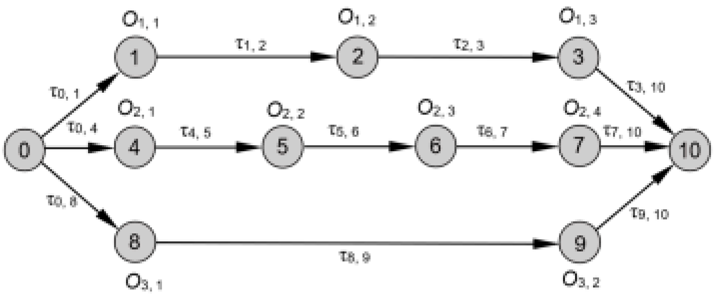

Figure 3. Figure 3. Disjunctive graph of Ant Colony Optimization (ACO) algorithm.
file:///C:/Users/Admin/Downloads/applsci-09-04815.pdf

Initially, the pheromone values of all the possible paths are equal to an initial value, τ_0. Each ant of the colony builds a tour by repetitively using a random greedy rule called the state transition rule as defined in Equation. According to this rule, an ant will decide which path to follow based on the pheromone deposited on each feasible path.

{argmax$u$∈$J(r)${[$\tau(r, u)$]·[$\eta(r,u)\beta$]},s,if q≤q0 (exploitation)otherwise (biased exploitation)(1)

(r, u) represents the path connecting nodes r and u, and $\tau(r, u)$ is the pheromone value on that path. If the ant is travelling from node r to node u, the value $\eta(r, u)$is calculated as $\eta(r, u) = 1/pi,j$where pi,j is the processing time of the operation Oij that corresponds to node u, q is a uniformly distributed random number in [0,1], $q0$ is a predefined parameter with $(0 \le q0 \le 1)$, β is the controlled parameter relating the importance of processing times of the operations. $J(r)$ is the set of nodes to which the ant can choose to travel from the current node. This set of possible nodes includes the nodes that have not been visited and follows the precedence constraints. The variable s is randomly chosen using the probability distribution given below.

$$P(r,s) = \begin{cases} \frac{[\tau(r,\, s)]\cdot[\eta(r,s)^{\beta}]}{\sum_{u\in J(r)}[\tau(r,\, u)]\cdot[\eta(r,u)^{\beta}]}, & \text{if } s \in J(r) \\ 0, & \text{otherwise} \end{cases} \tag{2}$$

While an ant travels from node r to node s, it deposits an amount of pheromone along the path. This action is realized in the algorithm by the local pheromone updating rule as follow.

$$\tau(r,s) \leftarrow (1-\rho)\cdot\tau(r,s)+\rho\cdot\tau 0$$

where ρ is the local pheromone evaporation rate $(0<\rho< 1)$

Once all the ants of the colony have completed their tours, the schedule to execute the operations can be built based on the sequence of nodes that each ant has visited during the tour. The operations are scheduled by following the sequence of the nodes as soon as the required machines are available. Afterwards, the time to complete all the operations of each ant, $Cmax$ is defined from the schedule. The best tour provides the minimum value of $Cmax$. Subsequently, the *global pheromone updating rule* is performed as follow.

$$\tau(r,s) \leftarrow (1-\alpha)\cdot\tau(r,s)+Q\cdot\alpha\cdot\Delta\tau(r,s)$$

Where

$$\Delta\tau(r,s) = \begin{cases} \frac{1}{\min C_{\max}}, & \text{if } (r,s) \in \text{global} - \text{best} - \text{tour} \\ 0, & \text{otherwise} \end{cases} \tag{3}$$

α is the global pheromone evaporation rate which control the influence of the new best solution, Q is a tuning parameter. With the new updated values of pheromone on all the possible paths, the process, where all the ants build their tours until the global pheromone updating rule is performed, is iterated until the solution (Cmax)min converges and the scheduling optimization is completed.

file:///C:/Users/Admin/Downloads/applsci-09-04815.pdf

LITERATURE REVIEW

2.1. SURVEY OF RECENT REVIEW PAPERS

Peng Hang et.al (2022)A game-theoretic decision-making framework is introduced in this paper to facilitate coordination among connected automated vehicles (CAVs) operating in urban environments. The primary objective of the framework is to optimize the efficacy, safety, and individual user benefits of the traffic system. With unsignalized intersections serving as an illustrative example of urban traffic conditions, CAVs engage in collaborative decision-making upon entering this zone. In order to facilitate decision-making and evaluate the safety of encircling vehicles, driving risk assessment employs a Gaussian potential field approach. Safety and transit efficiency are incorporated into the decision-making cost function, whereas safety, comfort, efficiency, control, and stability are represented by constraints. By applying the fuzzy coalitional game approach, two distinct categories of fuzzy coalitions are generated, each representing individual and social benefits associated with CAV-induced aggression. The effectiveness and viability of the framework are illustrated by means of three test cases, which underscore its capacity to augment coordination and safety among urban CAVs.**Kai Gao et.al (2020)** This paper explores the evolution of intersection control strategies in response to advancements in vehicle communication networks and connected vehicle technologies. Real-time data from these systems, including video monitoring and automated vehicles, offer high-quality input for traffic control. However, existing adaptive control systems often struggle to effectively utilize this data. The paper reviews intersection control strategies, ranging from intelligent data-driven control to conventional timing methods, induction control, and model-based approaches. It identifies three main directions for intersection control in the connected vehicle environment: data-driven reinforcement learning, adaptive performance optimization, and research on traffic control with connected vehicles. Additionally, the review discusses multiple intersection control strategies within this environment. The focus is on developing a clearer understanding of data-driven intelligent control theory and its application in intelligent transportation systems.**Azim Eskandarian et.al (2019)**Autonomous vehicle (AV) technology offers safe and convenient transport, yet real-world complexities pose challenges. Connected autonomous vehicles (CAVs) with vehicle connectivity improve situational awareness and enable AV cooperation, enhancing future transportation solutions. This paper presents a typical CAV architecture and surveys recent research in sensing, perception, planning, and control. It reviews a multi-layer Perception-Planning-Control framework, covering on-board sensors, sensor fusion, decision-making algorithms, and control strategies. The impact of vehicle connectivity, including challenges like cooperative perception and multi-vehicle control, is discussed. Critical review highlights remaining challenges, aiding researchers. This comprehensive overview serves academics, practitioners, and students in understanding CAV advancements and future directions.**Tri-Hai Nguyen et.al (2020)** This study addresses the multi-source multi-destination traffic routing problem for connected vehicles. An Ant Colony Optimization (ACO)-based routing method, employing the concept of coloring ants, is proposed for distributed solving. By distinguishing traffic flows to different destinations, this method enhances efficiency. Simulations on the NetLogo platform demonstrate the superiority of the ACO-based method over shortest path-based routing. Results show an average 8% reduction in travel time and a 13% increase in total arrived vehicles. In the best-case scenario, travel time decreases by 11% and arrived vehicles increase by 23%. This highlights the effectiveness of ACO in dynamic traffic routing for connected vehicles. **Sahar Ebadinezhad et.al (2019)** With the rise of the Internet of Vehicles (IoV), it's harder to keep up with the changing nature of interactions between vehicles, which affects how well networks can grow and route data. In this work, CACOIOV is suggested as an intelligent system-based method that uses Ant Colony Optimization (ACO) to improve packet routing and keep the structure stable. The mobility-aware DA-TRLD program also changes the broadcast range based on how much traffic there is in the area. CACOIOV performs better than traditional protocols like AODV and ACO in NS-2 models, showing better speed, packet delivery, drop ratio, cluster numbers, and average end-to-end delay. This new method solves problems with scale and safety in IoV, which could lead to big steps forward in vehicle communication systems.**Umberto Montanaro et.al (2018)** within this study Potential solution to issues such as traffic congestion, safety, fuel inefficiency, and emissions may be connected autonomous vehicles. They improve the performance of autonomous vehicles and facilitate cooperative capabilities, such as cooperative sensing and maneuvering, through the utilization of communication systems. Cooperative sensing entails the exchange of sensor data to enhance comprehension of the environment, whereas cooperative maneuvering facilitates coordinated driving to promote a safer and more efficient setting. The advantages of connected autonomous vehicles in five different use cases—vehicle platooning, lane changing, intersection management, energy management, and road friction estimation—are examined in this paper. It emphasizes that although connectivity can enhance transportation systems and vehicle performance, the precise advantages are contingent on variables such as the penetration of connected vehicles, traffic conditions, and the incorporation of off-board information into vehicle control systems.**Nirajan Shiwakoti et.al (2019)**As the implementation of Connected and Autonomous Vehicles (CAVs) approaches, there are ongoing uncertainties concerning the equilibrium between the advantages and disadvantages. The objective of this study is to consolidate current research in the field and identify gaps that necessitate additional inquiry. Further investigation was warranted into three pivotal sub-areas: adaptive tolling systems, autonomous parking facilities, and the prediction of adoption trajectory. Current research on adaptive tolling frequently fails to account for dynamic traffic conditions and unforeseen occurrences. In a similar fashion, research on autonomous parking ought to incorporate simulations of practical situations involving a diverse range of operational vehicles. Although discourse frequently highlights the favorable aspects of CAVs, doubts persist, particularly with regard to the rates of market penetration. Numerous studies make the assumption of a 100 percent CAV market share, but the actuality is likely to diverge. Further research is warranted to examine the various factors that influence adoption rates of CAVs, in order to attain a more comprehensive understanding of the implementation and consequences of CAVs**.FARAN AWAIS BUTT et.al (2022)** Intelligent, connected, and autonomous vehicles are gaining traction in the automotive industry in an effort to improve safety and alleviate traffic congestion. Connected and autonomous vehicles (CAV) operate through situational awareness and take appropriate actions in response to their surroundings. This review article examines in depth how to enable sensor fusion and wireless technologies for CAVs. It addresses the fusion of data acquired via RADAR, LiDAR, and cameras via multi-modal sensor fusion subsequent to signal processing. Furthermore, it examines the networking and communication infrastructure that facilitates both intra-vehicle and inter-vehicle interaction. For each theme, research challenges and future directions are identified throughout the assessment, providing a comprehensive summary of the current state and prospective developments of the technology.**Toru Seo et.al (2022)**Integrating operational aspects through the utilization of macroscopic dynamic traffic assignment, this research paper introduces a unified optimization framework designed to facilitate strategic planning of Shared Autonomous Vehicle (SAV) systems. In addition to optimizing fleet size, road network design, and parking space allocation, the model takes into account the dynamic routing of SAVs in the context of ridesharing and passenger retrieval etc. The objective is to minimize the total travel time, the total distance travelled by SAVs, the total number of SAVs, and the infrastructure cost. This is a multi-objective optimization problem. By incorporating explicit trade-off analysis, this comprehensive approach considers costs on both the user and system sides. Riding sharing can reduce costs for both users and the system, according to an intriguing finding and the linear programming formulation that simplifies the solution. By evaluating the model with taxi data from New York City, its efficacy is demonstrated.**Prabhjot Singh et .al** (2018) Particularly pertinent for the collection and transmission of healthcare data in Vehicular Adhoc Networks (VANETs), this research paper proposes a secure data dissemination scheme for Vehicular Relay Networks (VRNs). Potential network performance-degrading assaults, such as selective forwarding, blackhole, and sinkhole attacks, are mitigated by the scheme. A secure vehicular medical relay network system is implemented for rural regions, wherein data is filtered at the zonal level prior to being transmitted to Road Side Units (RSUs) and subsequently to vehicles. Furthermore, a secure passenger health monitoring network is devised, which employs diminutive body sensors installed in vehicles to oversee the well-being of passengers. Secure communication is guaranteed by a robust cryptographic solution based on Elliptic Curve Cryptography (ECC). Evaluation across a variety of network scenarios reveals enhanced performance, guaranteeing effective message delivery despite vehicle mobility, with a 52% reduction in average latency and a 5% increase in packet delivery ratio.**Hui Cui et.al (2019)**This paper introduces a framework that utilizes attributes to ensure secure communications in Vehicular Ad Hoc Networks (VANETs), thereby providing a number of significant benefits. The Attribute-Based Signature (ABS) is employed by the framework to ensure the integrity of messages and safeguard the privacy of vehicles. In comparison to current solutions that rely on symmetric, asymmetric, identity-based cryptography, and group signatures, this method substantially decreases latency, particularly with regard to revisions or modifications to pseudonyms or private keys. Furthermore, the framework incorporates traceability and revocation mechanisms into a standard ABS scheme, enabling a trusted authority to trace and revoke vehicles. This integration effectively tackles the issue of anonymity misuse that arises in credential-based anonymous vehicular protocols. By implementing and evaluating the proposed ABS scheme with the Charm rapid prototyping tool, its performance advantages are demonstrated**. Jie Cui et.al (2015)** The objective of this article is to propose the Secure and Private Authentication for Communication in VANETs (SPACF) scheme as a solution to the security issues that arise in VANETs. It is critical to ensure the authenticity of messages exchanged between roadside devices and vehicles; messages must be signed and verified. In contrast to alternative approaches, the SPACF scheme operates on a software-centric framework rather than depending on specialised hardware. The Cuckoo Filter and binary search methods are employed to augment the rates of success in bulk verification. Message authentication is ensured by the scheme via the existential unforgeability of the underlying signatures, which protects against adaptively chosen-message attacks. The efficacy of the scheme is demonstrated in comparison to previous approaches through its lack of coupling and utilisation of map-to-point hash functions, as indicated by the evaluation results. In general, SPACF effectively fulfils the security and privacy prerequisites for VANETs.**Ning Lu et.al (2014)**With an emphasis on strategic planning, this study presents a unified optimisation framework for Shared Autonomous Vehicle (SAV) systems. When optimising fleet size, road network design, and parking space allocation, the framework takes into account the dynamic routing of

SAVs used for ridesharing and passenger pickup/delivery. It is designed as a multi-objective optimisation problem with the following objectives: minimise the total travel time, total distance travelled by SAVs, total number of SAVs, and cost of infrastructure construction. By balancing costs on the user and system sides, this method permits explicit trade-off analysis. By applying linear programming, the research establishes a significant property: the implementation of ridesharing can reduce user-side and system-side expenses in a weakly monotonic fashion. Using actual taxi data from New York City, the proposed model is evaluated to demonstrate its efficacy and practicality in optimising SAV systems.

Table :1 Literature Survey

Author	Methods	Parameters	Updating	Results
Peng Hang et.al (2022)	Game-theoretic decision-making framework for coordination among CAVs in urban environments.	Fleet size optimization, road network design, parking space allocation, dynamic routing with passenger pickup/delivery and ridesharing.	Gaussian potential field approach for driving risk assessment. Fuzzy coalitional game approach for decision-making at unsignalized intersections.	Improved efficacy, safety, and individual user benefits of traffic system.
Kai Gao et.al (2020)	Review of intersection control strategies integrating vehicle communication networks and connected vehicle technologies.	Intelligent data-driven control, conventional timing methods, induction control, model-based approaches.	Focus on data-driven intelligent control theory and its application.	Better understanding of intelligent control theory for transportation systems.
Azim Eskandarian et.al (2019)	Overview of CAV architecture and research in sensing, perception, planning, and control.	Perception-Planning-Control framework, on-board sensors, sensor fusion, decision-making algorithms, control strategies.	Emphasis on the impact of vehicle connectivity, challenges in cooperative perception and multi-vehicle control.	Provides insights into CAV advancements and future directions for researchers.
Umberto Montanaro et.al (2018)	Examination of connected autonomous vehicles' benefits in five use cases: vehicle platooning, lane changing, intersection management, energy management, road friction estimation.	Cooperative sensing, cooperative maneuvering, vehicle platooning, lane changing, intersection management, energy management, road friction estimation.	Emphasizes advantages and challenges of CAVs, considering market penetration, traffic scenarios, and off-board information integration.	Shows potential improvements in transportation systems and vehicle performance with CAVs.
Nirajan Shiwakoti et.al (2019)	Review of CAV uncertainties and investigation into adaptive tolling systems, autonomous parking facilities, and adoption prediction.	Adaptive tolling systems, autonomous parking facilities, adoption prediction.	Highlights the need for considering varying CAV adoption rates, market penetration, and simulation of operational scenarios.	Aims to provide a comprehensive understanding of CAV implementation and impacts.
FARAN AWAIS BUTT et.al (2022)	Examination of enabling sensor fusion and wireless technologies for CAVs.	Sensor fusion, RADAR, LiDAR, cameras, networking and communication infrastructure.	Addresses research challenges and future directions in sensor fusion and networking for CAVs.	Offers insights into advancements and potential developments in CAV technology.
Toru Seo et.al (2022)	Proposal of a unified optimization framework for SAV systems considering fleet size, road network design, parking space allocation, and dynamic routing.	Multi-objective optimization, linear programming, dynamic routing, ridesharing.	Utilizes linear programming to optimize user and system-side costs, demonstrating effectiveness with NYC taxi data.	Shows optimized SAV systems with reduced travel time and infrastructure costs.
Prabhjot Singh et.al (2018)	Proposal of a secure data dissemination scheme using VRNs for healthcare data collection in VANETs.	Vehicular Relay Networks (VRNs), secure vehicular medical relay network, secure passenger health monitoring network, Elliptic Curve Cryptography (ECC).	Addresses security issues in VRNs, such as selective forwarding, blackhole, and sinkhole attacks.	Demonstrates improved network performance with a 52% reduction in average delay and 5% increase in packet delivery ratio.
Hui Cui et.al (2019)	Introduction of an attribute-based framework for secure communications in VANETs using ABS and traceability mechanisms.	Attribute-Based Signature (ABS), traceability mechanisms, secure communication.	Introduces ABS for message authentication and privacy protection in VANETs, addressing anonymity misuse issues.	Provides a secure and efficient solution for communication in VANETs.
Tri-Hai Nguyen et al. (2020)	ACO-based Routing with Coloring Ants	Multi-source multi-destination traffic routing problem	Employing Ant Colony Optimization (ACO) and coloring ants for routing	Demonstrates superiority over shortest path-based routing with 8% average travel time reduction, 13% increase in arrived vehicles. Best case: 11% travel time decrease, 23% more arrived vehicles.

Sahar Ebadinezhad et al. (2019)	CACOIOV with DA-TRLD for IoV	Changing vehicular communications in IoV	Using CACOIOV algorithm with enhanced ACO and mobility-aware DA-TRLD	Outperforms AODV and traditional ACO in NS-2 simulations with better throughput, packet delivery, drop ratio, cluster numbers, and end-to-end delay. Solves IoV scalability and stability issues.

Conclusion

In summary, the progression of dynamic decision-making in the context of connected vehicles presents a positive path towards the creation of transport systems that are both safer and more efficient. By employing advanced algorithms and real-time data, these vehicles are capable of maneuvering through complex and ever-changing environments with increased accuracy and agility. This technological advancement has the capacity to significantly transform the way we travel by providing remedies for enduring issues such as traffic congestion and road safety. Nevertheless, the path towards extensive implementation is not devoid of challenges. Vigils pertaining to cybersecurity, the smooth assimilation of infrastructure, and obtaining approval from the general public are substantial impediments that demand resolution. In order to tackle these challenges, a comprehensive strategy is necessary, which entails cooperation between industry frontrunners, policymakers, and the general public in order to establish a conducive atmosphere for connected vehicles. Notwithstanding these obstacles, the advantages of interconnected automobiles are indisputable. They possess the capability to significantly mitigate incidents, alleviate traffic congestion, and improve communities' and individuals' overall mobility. In order to completely actualize these benefits, ongoing investment in research and technology is crucial. Furthermore, it is critical to establish a framework that promotes innovation and guarantees the secure and efficient integration of connected vehicles into our transportation systems by encouraging collaboration among stakeholders. By means of collaborative endeavours, the complete capacity of dynamic decision-making for interconnected vehicles can be unlocked, inaugurating an unprecedented epoch in transportation efficacy and security.

FUTURE SCOPE

The future scope for dynamic decision-making in connected vehicles is vast and holds immense potential for transforming transportation systems worldwide. Advancements in artificial intelligence, machine learning, and data analytics will continue to refine the capabilities of these vehicles, enabling them to make split-second decisions in complex environments. Enhanced connectivity through 5G and beyond will facilitate seamless communication between vehicles, infrastructure, and pedestrians, further improving safety and efficiency. Moreover, the integration of autonomous features will redefine the concept of driving, offering increased convenience and accessibility. As this technology matures, we can anticipate a future where connected vehicles play a central role in smart cities, optimizing traffic flow, reducing emissions, and providing personalized transportation experiences. The journey ahead involves ongoing research, collaboration across industries, and the development of robust regulatory frameworks to ensure the responsible and effective implementation of dynamic decision-making in connected vehicles.

References

[1] U. Montanaro *et al.*, “Towards connected autonomous driving: review of use-cases,” *Veh. Syst. Dyn.*, vol. 57, no. 6, pp. 779–814, 2019, doi: 10.1080/00423114.2018.1492142.
[2] B. Brehmer, “Dynamic decision making: Human control of complex systems,” *Acta Psychol. (Amst).*, vol. 81, no. 3, pp. 211–241, 1992, doi: 10.1016/0001-6918(92)90019-A.
[3] P. Hang, C. Huang, Z. Hu, Y. Xing, and C. Lv, “Decision Making of Connected Automated Vehicles at an Unsignalized Roundabout Considering Personalized Driving Behaviours,” *IEEE Trans. Veh. Technol.*, vol. 70, no. 5, pp. 4051–4064, 2021, doi: 10.1109/TVT.2021.3072676.
[4] P. Hang, C. Huang, Z. Hu, and C. Lv, “Decision Making for Connected Automated Vehicles at Urban Intersections Considering Social and Individual Benefits,” *IEEE Trans. Intell. Transp. Syst.*, vol. 23, no. 11, pp. 22549–22562, 2022, doi: 10.1109/TITS.2022.3209607.
[5] J. Liu and A. Khattak, “Informed decision-making by integrating historical on-road driving performance data in high-resolution maps for connected and automated vehicles,” *J. Intell. Transp. Syst. Technol. Planning, Oper.*, vol. 24, no. 1, pp. 11–23, 2020, doi: 10.1080/15472450.2019.1699076.

[6] J. Nie, J. Zhang, W. Ding, X. Wan, X. Chen, and B. Ran, "Decentralized Cooperative Lane-Changing Decision-Making for Connected Autonomous Vehicles∗," *IEEE Access*, vol. 4, pp. 9413–9420, 2016, doi: 10.1109/ACCESS.2017.2649567.
[7] K. Gao, S. Huang, J. Xie, N. N. Xiong, and R. Du, "A review of research on intersection control based on connected vehicles and data-driven intelligent approaches," *Electron.*, vol. 9, no. 6, 2020, doi: 10.3390/electronics9060885.
[8] C. Gonzalez, "Decision support for real-time, dynamic decision-making tasks," *Organ. Behav. Hum. Decis. Process.*, vol. 96, no. 2, pp. 142–154, 2005, doi: 10.1016/j.obhdp.2004.11.002.
[9] F. A. Butt, J. N. Chattha, J. Ahmad, M. U. Zia, M. Rizwan, and I. H. Naqvi, "On the Integration of Enabling Wireless Technologies and Sensor Fusion for Next-Generation Connected and Autonomous Vehicles," *IEEE Access*, vol. 10, pp. 14643–14668, 2022, doi: 10.1109/ACCESS.2022.3145972.
[10] S. Li, K. Shu, C. Chen, and D. Cao, "Planning and Decision-making for Connected Autonomous Vehicles at Road Intersections: A Review," *Chinese J. Mech. Eng. (English Ed.*, vol. 34, no. 1, 2021, doi: 10.1186/s10033-021-00639-3.
[11] K. H. N. Bui and J. J. Jung, "ACO-Based Dynamic Decision Making for Connected Vehicles in IoT System," *IEEE Trans. Ind. Informatics*, vol. 15, no. 10, pp. 5648–5655, 2019, doi: 10.1109/TII.2019.2906886.
[12] A. Eskandarian, C. Wu, and C. Sun, "Research Advances and Challenges of Autonomous and Connected Ground Vehicles," *IEEE Trans. Intell. Transp. Syst.*, vol. 22, no. 2, pp. 683–711, 2020, doi: 10.1109/TITS.2019.2958352.
[13] N. Lu, N. Cheng, N. Zhang, X. Shen, and J. W. Mark, "Connected vehicles: Solutions and challenges," *IEEE Internet Things J.*, vol. 1, no. 4, pp. 289–299, 2014, doi: 10.1109/JIOT.2014.2327587.
[14] P. Singh, R. S. Bali, N. Kumar, A. K. Das, A. Vinel, and L. T. Yang, "Secure Healthcare Data Dissemination Using Vehicle Relay Networks," *IEEE Internet Things J.*, vol. 5, no. 5, pp. 3733–3746, 2018, doi: 10.1109/JIOT.2018.2865008.
[15] H. Cui, R. H. Deng, and G. Wang, "An Attribute-Based Framework for Secure Communications in Vehicular Ad Hoc Networks," *IEEE/ACM Trans. Netw.*, vol. 27, no. 2, pp. 721–733, 2019, doi: 10.1109/TNET.2019.2894625.
[16] J. Cui, J. Zhang, H. Zhong, and Y. Xu, "SPACF: A secure privacy-preserving authentication scheme for VANET with cuckoo filter," *IEEE Trans. Veh. Technol.*, vol. 66, no. 11, pp. 10283–10295, 2017, doi: 10.1109/TVT.2017.2718101.