SuperHyperSoft-Driven Evaluation of Smart Transportation in Centroidous-Moosra: Real-World Insights for the UAV Era

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Abstract: Over recent decades unmanned aerial vehicles (UAVs) have significantly impacted many areas and applications that affect our daily lives. Such as transportation, healthcare, and agricultural surveillance and management. Along with intelligently digitizing these sectors. Hence, this study focuses on exhibiting UAVs' contributions to transportation systems to be smart. An intelligent decision-maker framework is constructed to evaluate smart transportation systems (STSs) that leverage UAVSs in their operations. Preferencing candidates of STSs conduct the evaluation process based on a set of criteria and attributes. Moreover, the new multi-criteria decision-making (MCDM) of centroidous to obtain criteria attribute weights. As well as Multi-objective optimization on the basis of simple ratio analysis (Moosra) leverages the generated weights to rank STSs and recommend optimal STS. These MCDM techniques collaborated with the uncertainty theory of Single Value Neutrosophic Sets (SVNSs) to enhance decisions in ambiguous situations. Along with Moosra-SVNSs are integrating in the ranking process under the dominance of SuperHyperSoft (SHS) environment which depends on a set of hypersoftsets formed into a set of possibilities. Hence, we applied six possibilities in our constructed framework.

Keywords: Unmanned aerial vehicles (UAVs); smart transportation systems (STSs); centroidous; Moosra; SuperHyperSoft (SHS)

1. Introduction

Recently, an abundance of scholars has been eager to make various services and industries smarter and more sustainable by integrating cutting-edge technologies like Internet of Things (IoTs), Cyber-physical systems (CPS), digital twin (DT), deep learning (DL) as a portion of machine learning (ML)…etc. In this regard smart cities [1]strives to be an innovative concept in modern society, rendering social services more accessible while being beneficial, fostering sustainability, and making life easier for residents. One sector wherein stakeholders must implement contemporary technologies in the realm of smart cities is the transportation sector to be smart.

1.1 The problem at hand in the study

Herein, we exhibit the study's problems through a set of dimensions. Wherein each dimension exhibits a certain problem. Hence, it considers the motivation for conducting the study to solve it.

1.1.1 First dimension-D1: Ecological and societal problems

Transportation services are mandatory for people's everyday existence [2].Regretfully, this sector faces numerous obstacles. As noted in [3]Vehicle development will continue to accelerate globally due to the expanding urban population, which will harm the environment and make issues like traffic congestion, noise pollution, and accidents worse. Hence, it harms society and the economy owing to [4] the growing number of vehicles and inadequate road capacity cause traffic congestion to worsen every year. Debated that [5] Behavioral lapses, such as excessive speeding, driving while inebriated and losing concentration, and ignoring safety equipment like seat belts, all contribute to catastrophes and emergencies.

Generally, these issues are jeopardy for the intentions of the Sustainable Development Agenda (SDA). Ecologically[6]nearly 25% of worldwide energy-related emissions are caused by transportation, making it a major source of greenhouse gas emissions. This presents a significant obstacle in the prevailing against climate change and the pursuit of sustainable objectives. Socially[7] environmental risks brought on by fossil fuels are associated with respiratory and cardiovascular ailments as well as early mortality. Increased stress and a lower quality of life have been associated with long commutes and traffic [8].Economically [9] Transportation and its associated infrastructure impact economic growth through various pathways, including employment, industrial activity, productivity, competitiveness, property values, and tax revenues.

- **Proposition-P1: Innovative Solutions**

Numerous studies [2] proclaimed that increased use of information technology (IT) is essential to enhancing the operational efficacy of transportation services. In line with [10] deploying cutting-edge sensors, technological devices, and communication technologies in tandem with management techniques to increase transportation services' efficiency and safety. These technologies contribute to churning out smart transportation systems (STSs) [11] to achieve sustainable transportation systems (STSs). Due to [12] intelligent traffic signal control, vehicle surveillance, road condition updates, handling traffic in real time, and autonomous vehicle system deployment. Fig 1 exhibits the role of ICT in STS.

1.1.2 Second dimension-D2: Appraising Smart Transportation System

According to Figure 1, harnessing cutting-edge technologies in transportation services, operations, and planning has a positive implication. To achieve digitizing services of transportation accompanied by its sustainability. From the perspectives of scholars as [13]Evaluating the extent of transportation's efficacy and sustainability is imperative. The evaluation process has been conducted based on a set of criteria related to deployed technologies and sustainability pillars.

Accordingly, multi-criteria decision-making (MCDM) [14] is regarded as an intricacy method for balancing a multitude of opposing criteria and objectives. In line with [15] sustainability of transportation systems has been evaluated through entropy to obtain weights for criteria related to pillars of sustainability and a Combined Compromise Solution (CoCoSo) for recommending the optimal alternative of transportation systems.

Despite the MCDM approaches' ability to take into account the disproportionate and conflicting effects of actions, the solutions offered contradict several objectives, which means that the optimal point is not reached because of the nature of the issue [16].

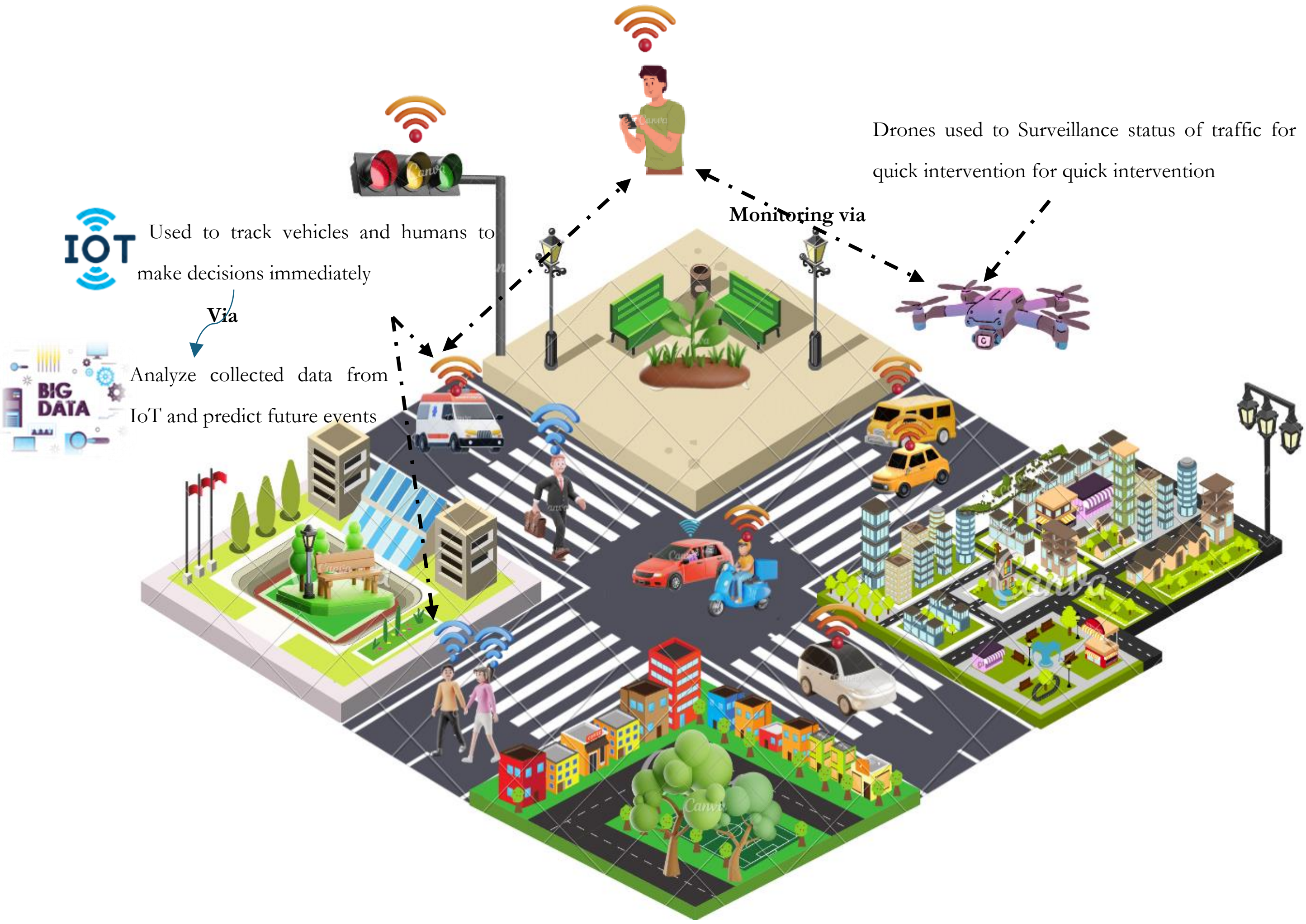

Figure 1. Deploying cutting-edge technologies toward smart transport systems

- **Proposition-P2: Leveraging Members Family of Uncertainty Theory**

To combat the issue mentioned in [16], the scholars integrated MCDM with techniques for handling uncertainty and vagueness information[17]; a thorough evaluation of alternatives may be performed by using uncertainty techniques with MCDM, which may effectively assess alternatives based on several conflicting criteria[18]. Hence[13] they have enacted a new integrated method to evaluate sustainable vehicles according to the expert-identified criteria. Compromise solution (MARCOS) techniques under Spherical Fuzzy Set (SFS) which belongs to uncertainty theory are used for ranking alternatives by leveraging weights of criteria obtained from SFS-based Stepwise weight assessment ratio analysis (SWARA). In the same vein [19] integrated type 2 neutrosophic sets (T2NSs) as a branch of uncertainty theory with entropy and Complex Proportional Assessment (COPRAS) of MCDM to evaluate digital twin applications.

1.2 Contributions of Study

Based on prior scholars' perceptions of the importance of leveraging cutting-edge technologies in transportation to make its services smart and gain customer satisfaction. This study discusses novelty perceptions in solving transportation problems as a set of contributions.

Firstly: Although [20] discussed the importance of IoT in transportation through automated fee collection, vehicle surveillance, and the effectiveness of logistics; IoT in [21] suffers from some challenges such as interoperability, data security and privacy, and the requirement for a strong infrastructure to accommodate an extensive number of connected devices. Hence, we exploit the capabilities of Unmanned Aerial Vehicles (UAV) that entailed gathering information to monitor and control traffic in real-time and congestion patterns[22]. Herein, we discuss the importance of UAV in transportation to be STS.

Second: As mentioned previously, recommending the most sustainable and smart transportation is imperative. This process is the result of the evaluation process for STSs based on a set of criteria. The evaluation is conducted based on data collected but this data may be incomplete or inaccurate which has negative effects on judgments and decisions. To eliminate doubt in judgments, we are implementing Neutrosophic theory and superhypersoft (SHS) as members of the family of uncertainty theory where [23] implemented for the first time to evaluate blockchain applications. As well as we also deploy SHS in our problem of evaluating STSs which harness UAVs to manage traffic for mitigating congestion. Generally, we are constructing a robust intelligent decision-maker by integrating MCDM with Neutrosophic theory and SHS to evaluate transportation systems.

Third: the efficacy and validation of constructed intelligent decision-makers to make accurate decisions and recommendations is vital. Hence, we applied this framework to real scenarios to verify it.

1.3 Simple Recap of Our Study: Objectives

Herein we exhibit the objective of the study and the procedures to which we adhere to achieve the determined objectives. As well as we showcase the procedures' results in the form of action as illustrated in Figure 2.

2. Decision Making Methodological

Various mathematical techniques have been collaborated to construct intelligent decision-makers for evaluation process to achieve the study's objectives. Each technique plays a vital role in this process, which will be showcased in the procedures of constructing intelligent decision-making to evaluate STSs that deploy and leverage UAVs' capabilities to manage traffic and mitigate overcrowding through traffic and road surveillance. Moreover, the following procedures describe how the evaluation process is conducted.

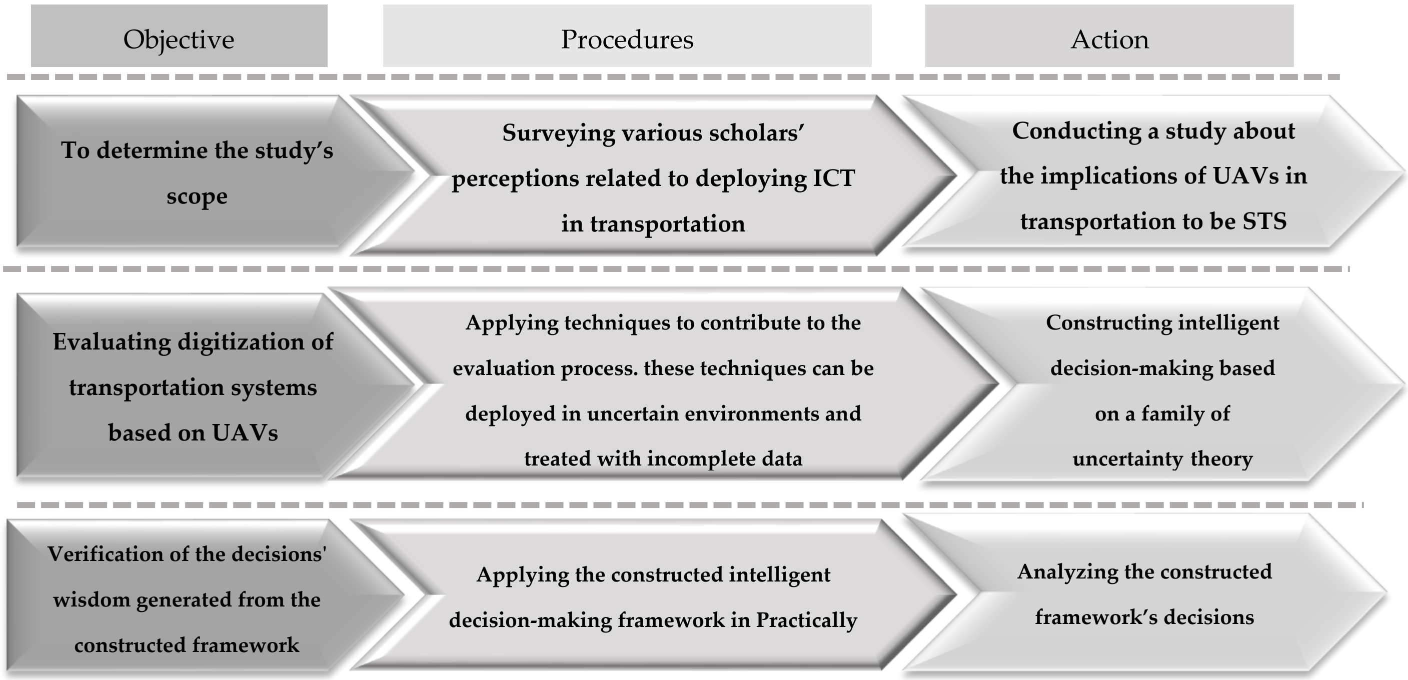

Figure 2. Study Summarization

2.1 Outlining the Essential Aspects of the Evaluation Procedure

1. Surveying STSs is currently in existence and deploying UAVs in their management and operations. Accordingly, these STSs have been volunteered in this process as alternatives.
2. Evaluating the volunteered STSs is conducted based on a set of criteria and their attributes. Hence, determining the criteria and their attributes related to adopting UAVs as automated surveillance.
3. Another important factor in the evaluation process is forming an expert panel to contribute based on criteria and their attributes.

2.2 Finding out criteria and their attributes' weights: SVNSs-Centroidous

Herein, the centroidous technique of MCDM is proposed by Zinkevič [24] for evaluating each criterion's significance concerning the group's overall center. This technique is used to generate criteria weights. Hence, as the following steps exhibit, we implement centroidous under the sovereignty of uncertainty theory of single-value Neutrostomic sets (SVNSs) to bolster the centroids in ambiguous situations.

4. STSs have been evaluated by a formed panel based on determined criteria. Linguistic scale in [25] have been used by the panel in evaluation. Hence, the decision matrices for panel evaluation have been constructed.

5. Linguistics decision matrices are converted into the corresponding neutrosophic scale to construct neutrosophic decision matrices.
6. The neutrosophic matrices are converted into crisp values by the score function in equation (1) .

$$s(\sigma_{ij}) = \frac{(2+\alpha-\beta-\theta)}{3} \tag{1}$$

Where α, β, θ refers to truth, false, and indeterminacy respectively.

7. The crisp matrices are integrated into an aggregated matrix based on equation (2).

$$\wp_{ij} = \frac{(\sum_{j=1}^{N} \sigma_{ij})}{N} \tag{2}$$

Where σ_{ij} refers to the value of the criterion in the matrix, and N refers to the number of decision-makers.

8. Normalizing the aggregated matrix by equation (3).

$$\widetilde{\delta_{ij}} = \frac{\wp_{ij}}{\sum_{j=1}^{m} \wp_{ij}} \tag{3}$$

9. Utilizing a normalized $\widetilde{\wp_{ij}}$, we determine the center of gravity of a distinct set of criteria based on equation (4).

$$c_j = \frac{1}{l}\sum_{i=1}^{n} \widetilde{\delta_{ij}} \tag{4}$$

10. The following formula is used to get the Euclidean distance between each criterion and the group center as in equation (5).

$$d_i = \sqrt{\sum_{j=1}^{m}\left(\widetilde{\delta_{ij}} - c_j\right)^2} \tag{5}$$

11. The criteria weights are generated through equation (6).

$$\widetilde{d_i} = \frac{\min_i(d_i)}{d_i} \tag{6}$$

12. The criteria weights are calculated based on equation (7)

$$w_i = \frac{\widetilde{d_i}}{\sum_{i=1}^{n} \widetilde{d_i}} \tag{7}$$

2.3 Discovering Optimal STS: Ranking Process

In this process, we integrated various techniques to implement together wherein Multi-objective optimization on the basis of simple ratio analysis (Moosra) collaborates with the uncertainty theory of SVNSs to rank candidates of STS. Alongside, these techniques are working under the sovereignty of SHS environment to examine the framework's decision based on the possibilities generated from SHS with MOOSRA-SVNSs.

2.3.1 SuperHyperSoft Environment

SHS is proposed by Smarandache [26] comprising many HyperSoft Sets, this method is seen as an extension of HyperSoft. In this study, SHS was used as the technique to represent the established criteria and their attributes to choose the best alternative based on the criteria and attributes that were chosen.

- Suppose the universe set $\Re$= {STS 1, STS 2… STS n}. Moreover, P ($\Re$) the powerset of $\Re$. As well as C1, C2, C3 are utilized attributes where STS platforms have been evaluated over these criteria. Hence, P(C1), P(C2), and P(C3) are powersets of C1, C2, C3 .

- Let F: P(C1) × P(C2) × P(C3) → P(ℜ), where × indicates to Cartesian product. Hence, this is called SHs over ℜ.
- For instance, Cartesian product for criteria and attributes formed as

$$P(C_1) \times P(C_2) \times P(C_3) = \Big\{\{\{A_{11}\},\{A_{12}\},\{A_{11},A_{12}\}\} \times \{\{A_{21}\},\{A_{22}\},\{A_{21},A_{22}\},\} \times$$

$$\{\{A_{31}\},\{A_{32}\},\{A_{33}\},\{A_{31},A_{32}\},\{A_{31},A_{33}\},\{A_{32},A_{33}\},\{A_{31},A_{32},A_{33}\}\}\Big\}.$$

- Moreover, equation (8)used to express $P(A_1) \times P(A_2) \times P(A_3) =$

$$\left\{\begin{array}{c}
\widetilde{\partial_1}\ (A_{11},A_{21},A_{31});\widetilde{\partial_2}\ (A_{11},A_{21},A_{32});\widetilde{\partial_3}\ (A_{11},A_{21},A_{33});\\
\widetilde{\partial_4}\ (A_{11},A_{21},\{A_{31},A_{32}\});\widetilde{\partial_5}\ (A_{11},A_{21},\{A_{31},A_{33}\});\widetilde{\partial_6}\ (A_{11},A_{21},\{A_{32},A_{33}\});\\
\widetilde{\partial_7}\ (A_{11},A_{21},\{A_{31},A_{32},A_{33}\});\widetilde{\partial_8}\ (A_{11},A_{22},A_{31});\ldots\widetilde{\partial_{14}}\ (A_{11},A_{22},\{A_{31},A_{32},A_{33}\});\\
\widetilde{\partial_{15}}\ (A_{11},\{A_{21},A_{22}\},A_{31});\ldots\widetilde{\partial_{21}}\ (A_{11},\{A_{21},A_{22}\},\{A_{31},A_{32},A_{33}\});\widetilde{\partial_{22}}\ (A_{12},A_{21},A_{31});\cdots\\
\widetilde{\partial_{28}}\ (A_{12},A_{21},\{A_{31},A_{32},A_{33}\});\widetilde{\partial_{29}}\ (A_{12},A_{22},A_{31});\cdots\widetilde{\partial_{35}}\ (A_{12},A_{22},\{A_{31},A_{32},A_{33}\});\\
\widetilde{\partial_{36}}\ (A_{12},\{A_{21},A_{22}\},A_{31});\ \cdots\widetilde{s_{42}}\ (A_{12},\{A_{21},A_{22}\},\{A_{31},A_{32},A_{33}\});\widetilde{\partial_{43}}\ (\{A_{11},A_{12}\},A_{21},A_{31});\cdots\\
\widetilde{\partial_{49}}\ (\{A_{11},A_{12}\},A_{21},\{A_{31},A_{32},A_{33}\});\widetilde{\partial_{50}}\ (\{A_{11},A_{12}\},A_{22},A_{31});\cdots\\
\partial\widetilde{s_{63}}\ (\{A_{11},A_{12}\},\{A_{21},A_{22}\},\{A_{31},A_{32},A_{33}\}).
\end{array}\right\} \quad (8)$$

2.3.2 Optimal STS: SVNSs-MOOSRA

This procedure is the sinew in the ranking process because the final decision depends on the results generated from this procedure. Overall, the ranking procedures have been conducted as follows:

1. Reapply the panel's evaluation from the previous procedure for attributes to construct Neutrosophic decision matrices.
2. These matrices have been constructed based on SHS possibilities where the attributes contributed to the evaluation of STSs and were selected based on SHS's possibilities.
3. The constructed matrices are transformed into de-neutrosophic decision matrices by using equation (1).
4. The crisp matrices are aggregated into an aggregated matrix based on equation (2).
5. The aggregated matrix is normalized based on equation (9).

$$\mathrm{Nor_{ij}} = \frac{\wp_{ij}}{\left[\sum_j^m \wp_{ij}\right]^{1/2}} \quad (9)$$

6. Compute a weighted decision matrix based on equation (10).

$$\text{i.}\mathfrak{H}_{ij}=\mathrm{Nor_{ij}} * w_i \quad (10)$$

7. Calculating ratio as in equation (11) to obtain the final rank for alternatives.

$$\mathrm{Ratio} = \frac{\sum_{j=1}^{B} \mathfrak{H}_{ij}}{\sum_{j=1}^{NB} \mathfrak{H}_{ij}} \quad (11)$$

3. Deploying Intelligent Decision Maker Framework in Reality: Case Study

To verify the efficiency of the constructed framework, we implemented it in a real case study. We communicated with five transportation systems as a result of surveys conducted for numerous transportation systems that deploy contemporary technologies such as UAVs to be smart transportation systems. Hence, we are applying the constructed framework to these systems as follows.

3.1 Ascertaining Initial Aspects

- First Aspect is alternatives: herein, five STSs have been leveraged to be candidates for our study. These alternatives are formed as $\mathrm{STS_n} = \{\mathrm{STS_1}, \mathrm{STS_2}, \ldots., \mathrm{STS_5}\}$.
- Second Aspect is criteria: we have determined a set of criteria related to the technology of UAVs and formed as $\mathrm{C_n} = \{\mathrm{C_1}, \mathrm{C_2}, \mathrm{C_3}\}$.
- Third Aspect is attributes related to determined criteria and formed as $\mathrm{A_{mn}} = \{\mathrm{A_{11}}, \mathrm{A_{12}}, \mathrm{A_{21}}, \mathrm{A_{22}}, \mathrm{A_{31}}, \mathrm{A_{32}}\}$. Table 1 also exhibits the description of the criteria and attributes utilized.

3.2 Valuation weights: SVNSs-Centroidous

- Three Neutrosophic decision matrices are constructed and transformed into de-neutrosophic (crisp) matrices by using equation (1).
- Aggregation matrix is constructed by deploying equation (2) into crisp matrices as listed in Table 2.
- Equation (3) applies in an aggregated matrix formed in Table 2 to generate a normalized matrix as mentioned in Table 3.
- Utilizing equation (4) to compute the vector of the center of gravity of a distinct set of criteria formed in Table 4.
- Euclidean distance between each criterion and the group center is calculated based on equation (5) and generated in Table 5.
- Equation (7) is utilized for generating criteria weights that are formed in Figure 3, where C1 has the highest value. Otherwise, C2 is the worst with the lowest value.

Table 1. Description of Utilized Criteria and Attributes

Technical Performance (C1)	
Reliability (A11)	Efficiency of transportation system operation based on UAV in a range of circumstances
Collision Rate (A12)	Rate of accidents caused by the system that adopted UAV
Organizational Efficacy (C2)	
Real-Time Processing (A21)	Ability to make decisions quickly by analyzing data as it is gathered.
Energy Consumption Metrics(A22)	analysis of the energy consumption for each flight or delivery distance.
Performance (C3)	
Speed of Data Collection (A31)	Time spent on data collection in comparison to conventional techniques.
Flight Time Analysis (A32)	Examination of average flight intervals for various delivery circumstances.

Table 2. An aggregated matrix

	C1	C2	C3
STS1	0.604444444	0.5722222	0.42666667
STS2	0.816666667	0.5777778	0.71666667
STS3	0.538888889	0.38	0.5
STS4	0.705555556	0.8055556	0.65
STS5	0.644444444	0.7111111	0.81666667

Table 3. Normalized Matrix

	C1	C2	C3
STS1	0.182611615	0.18781911	0.137191854
STS2	0.24672709	0.189642597	0.230439443
STS3	0.162806311	0.124726477	0.160771704
STS4	0.213158778	0.264405543	0.209003215
STS5	0.194696207	0.233406273	0.262593783

Table 4. Vector of center

Cj	0.169207526	0.2222697	0.14943483	0.228855846	0.230232088

Table 5. Vector of Euclidean distance

di	0.049657087	0.057404519	0.05159146

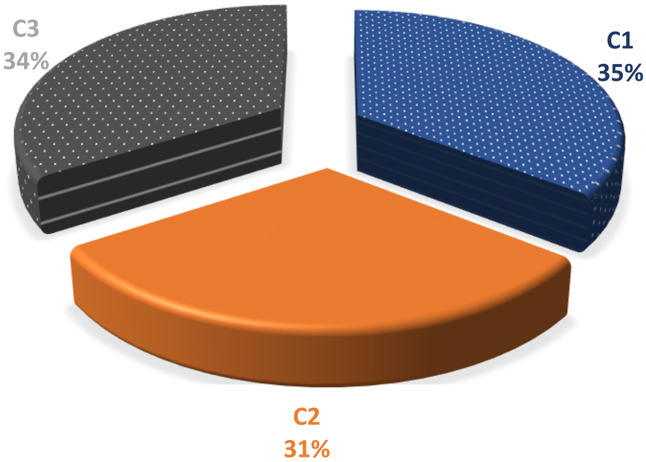

Figure 3. Criteria weights based on SVNSs-Centroidous

3.3 Recommending Optimal STSs

In this procedure, we generate optimal STS. Hence, three techniques have been leveraged to achieve the procedure's objective. SVNSs-MOOSR are collaborating in the environment of SHS. Wherein there are eight possibilities for attributes generated based on SHS and expressed as:

$$P(C_1) \times P(C_2) \times P(C_3) = \left\{\{\{A_{11}\},\{A_{12}\},\{A_{11},A_{12}\}\right\} \times \left\{\{A_{21}\},\{A_{22}\},\{A_{21},A_{22}\},\right\} \times$$

$$\left\{\{A_{31}\},\{A_{32}\},\{A_{33}\},\{A_{31},A_{32}\},\{A_{31},A_{33}\},\{A_{32},A_{33}\},\{A_{31},A_{32},A_{33}\}\right\}.$$

These possibilities contribute to constructing Neutrosophic decision matrices by deploying the previous rating for panel that are used in finding criteria and attributes weights.

- Let $F{:}P(C_1) \times P(C_2) \times P(C_3)$, hence the eight possibilities formed as:
  Possible 1: P1:{A11,A21,A31}.
  P2:{A11,A21,A32}.
  P3:{A11,A22,A31}.
  P4:{A11,A22,A32}.
  P5:{A12,A21,A31}.
  P6:{A12,A21,A32}.
  P7:{A12,A22,A31}.
  P8:{A12,A22,A32}.

3.3.1 According to P1:

- To construct decision matrices, we collect the previous panel's rate that was conducted for attribute weights. After that equation (1) was utilized for deneutrosophic matrices.
- Aggregate these matrices into an aggregated matrix based on equation (2) as in Table 6.

- normalized matrix is generated in Table 7 according to equation (9).
- weighted normalized matrix is generated based on equation (10) (see Table 8).
- The final ranking for STSs is exhibited in Figure 4, which indicates that STS2 is the optimal transportation system.
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Table 6. Aggregated Matrix

	A11	A21	A31
STS1	0.644444	0.644444	0.578889
STS2	0.498889	0.498889	0.32
STS3	0.42	0.42	0.42
STS4	0.598889	0.598889	0.598889
STS5	0.565556	0.666667	0.5

Table 7. Normalized Matrix

	A11	A21	A31
STS1	0.522865	0.502658	0.523548
STS2	0.40477	0.389127	0.289409
STS3	0.340764	0.327594	0.379849
STS4	0.485904	0.467125	0.541636
STS5	0.458859	0.519991	0.452201

Table 8. Weighted Decision Matrix

	A11	A21	A31
STS1	0.148122626	0.130715021	0.145157608
STS2	0.114667343	0.101191456	0.080240674
STS3	0.096535091	0.085190135	0.105315885
STS4	0.137651889	0.121474822	0.15017265
STS5	0.129990374	0.135222436	0.125376053

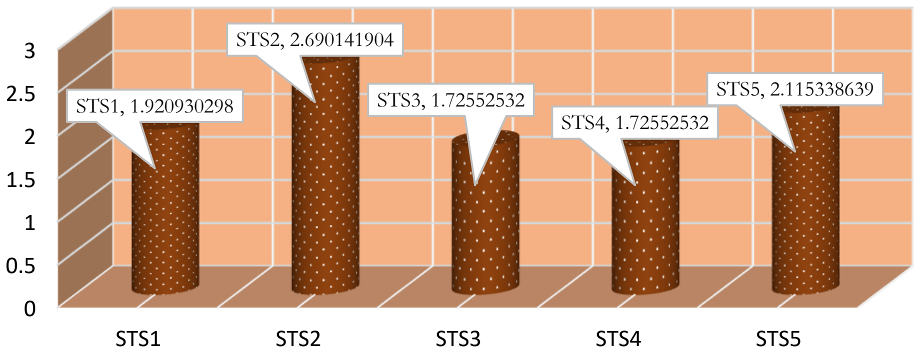
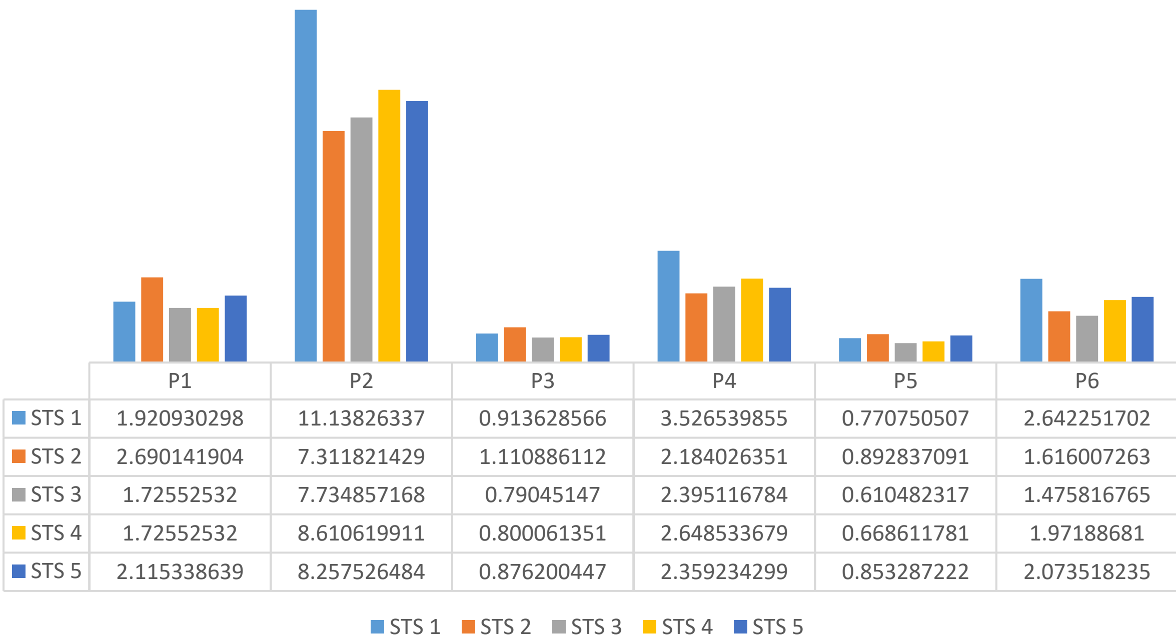


Figure 4. Ranking of STSs

3.3.2 Deploying Various SHS Possibilities

We applied five SHS possibilities to obtain the optimal STS among a set of alternatives, following the same steps mentioned in the previous section. Fig 5 exhibits the ranking of STSs based on implementing all possibilities in this study. According to Figure 5 STS 2 is optimal in possibilities of P1, P3, and P5 while STS1 is optimal in possibilities of P2, P4, and P6.



	P1	P2	P3	P4	P5	P6
STS 1	1.920930298	11.13826337	0.913628566	3.526539855	0.770750507	2.642251702
STS 2	2.690141904	7.311821429	1.110886112	2.184026351	0.892837091	1.616007263
STS 3	1.72552532	7.734857168	0.79045147	2.395116784	0.610482317	1.475816765
STS 4	1.72552532	8.610619911	0.800061351	2.648533679	0.668611781	1.97188681
STS 5	2.115338639	8.257526484	0.876200447	2.359234299	0.853287222	2.073518235

Figure 5. Ranking of STSs based on six possibilities

4. Conclusion

Herein, we surveyed the main technologies currently contributing to transforming transportation systems into smart transportation systems, providing a thorough overview of smart transportation systems and applications. One of these technologies is UAV, which has an immense impact on transportation automation. Due to its ability to conduct traffic surveillance and control through deploying advanced sensors and cameras for collecting real-time data related to traffic. As well as in the era of smart cities where IoT devices may collaborate with UAVs to provide a complete data ecosystem that improves urban transportation decision-making.

Moreover, this study seeks to exhibit UAVs' contributions to transportation systems to be smart. Accordingly, we constructed an intelligent decision-maker to evaluate STSs that deploy UAVs in their operations and management. The evaluation for STSs is conducted based on a set of criteria and their attributes. Hence, we harnessed centroidous as the new MCDM technique that was utilized for the first time in this problem and collaborated with SVNSs to obtain criteria and attribute weights. As well, the attributes' weights are leveraged in Moosra based on SVNSs to recommend the optimal STS. In the ranking process, Moosra based on SVNSs implemented under the dominance of SHS environment which depends on a set of hypersoftsets is formed into a set of possibilities. Hence, we applied six possibilities in our constructed framework.

The findings of the constructed framework indicated that STS 2 is optimal in the possibilities of P1, P3, and P5 while STS1 is optimal in the possibilities of P2, P4, and P6.

5. Future Contributions and Perceptions

The objective of this section is to showcase the authors' future perceptions that can be exploited in future research. Such as the challenges that obstruct the implementation of UAVs in transportation systems to be smart. Wherein the implementation of UAVs in smart transportation is fraught with difficulties, notwithstanding its potential advantages as ecological obstacles. Particularly susceptible to harsh weather conditions including strong winds, torrential rain, and extremely hot or low temperatures are UAVs. These elements may have an impact on battery performance and operational security. Another challenge is operational obstacles, such as barriers to communication. Hence, analyzing and evaluating these challenges is imperative to determine the most influential obstacle through deploying our constructed framework in this problem.

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