Towards Smart Education in IoT and IoB Environment using the Neutrosophic Approach

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Abstract

Due to the explosive growth of information in recent years, the function of education, which disseminates information, has become more important. Meanwhile, the paradigm of the educational process is undergoing a transformation to accommodate the many methods in which today's pupils learn. As a result, we should promote a more technologically advanced school setting. It uses a variety of technologies for communication and information to engage pupils and meet their individual needs. Continuously observing and evaluating the condition and actions of various students using information from various sensors and data processing platforms for providing feedback on the process of learning might improve the quality of learning for students. The potential for the IoT to improve people's quality of life and the efficiency of businesses is enormous. The Internet of Things (IoT) and Internet of behavior (IoB) have the potential to provide a new ecosystem for application development while also facilitating expansions and enhancements to key utilities in a wide variety of domains by means of a widely dispersed local network of intelligent items. Students will learn more quickly, and instructors will be able to do their jobs more effectively when the notion of the Internet of Things is used in any educational setting. The purpose of this article is to employ neutrosophic sets to demonstrate some of the most fundamental aspects of the Internet of Things. We used the MCDM methodology to evaluate the conflicting criteria, so we used the neutrosophic AHP method to compute the weights of the criteria, and then we used the neutrosophic VIKOR to rank the alternatives. We also demonstrated how IoT may help us make better choices in our everyday lives and contribute to a more intelligent educational system.

Keywords: Smart Education; IoT; Neutrosophic Sets; MCDM; Sensors; IoB

1. Introduction

The term "Internet of Things" (IoT) was first used in 1999 by Kevin Ashton, a contributor to the RFID design community. In recent years, its applicability to the global community has grown as a result of developments in mobile technology, pervasive communication networks, cloud services, and data analytics. One of the hottest topics in the field of information technology right now is the so-called "Internet of Things" (IoT). With the help of the Internet of Things, even inanimate things may gain intelligence. The IoT allows us to monitor and manage our surrounding environment by providing us with data on the condition of individual devices. For the purpose of providing optimal service delivery systems, it also takes into account net, sensor, big data, and AI technologies. As a result, the IoT makes it possible to improve the efficiency, effectiveness, and management of any given system. Figure 1 shows the business based on IoT[1]–[3].

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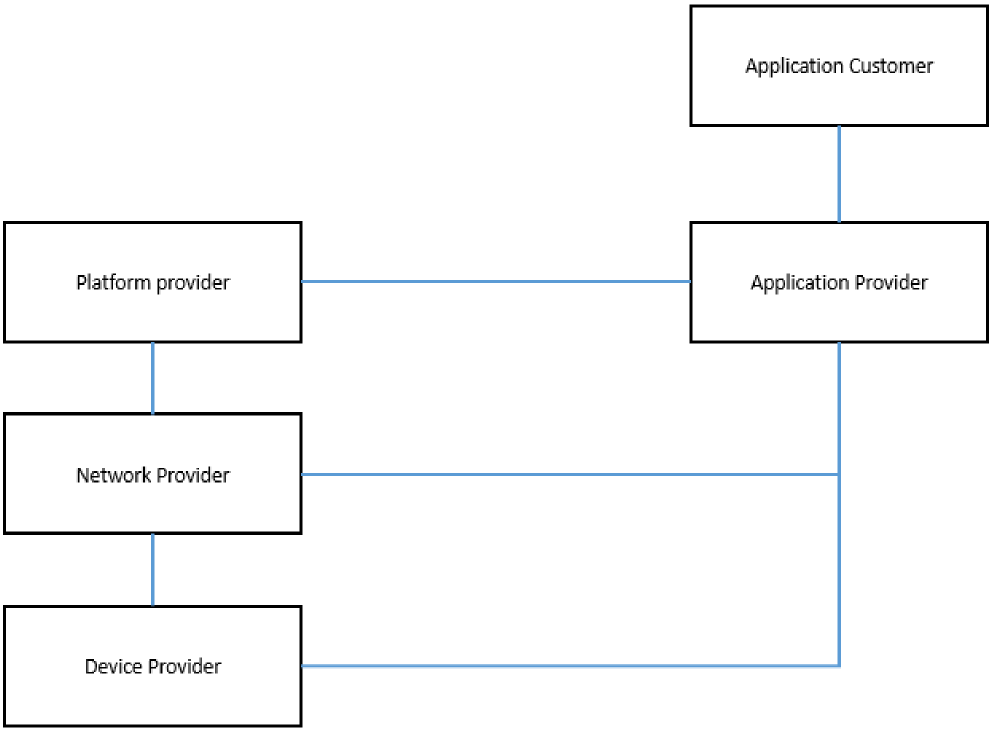

Figure 1: Business depends on IoT.

Businesses and ecosystems based on the Internet of Things rely on consumers having access to a variety of useful apps on a variety of interconnected devices.

They also increase collecting, automation, processing of data, and many more by employing smart devices and powerful supporting technologies. Internet of Devices may be identified as a group of things linked and working with each other to address diverse challenges. These items (things) be doing anything virtual (knowledge world) or material (physical world) as in Figure 2. The ability to recognize and include into the communication layer is a property of objects. Physical items include stuff like electrical gadgets, sensors, and so on. Multimedia files, Twitter profiles, and the like are all examples of digital artifacts that may be saved, processed, and retrieved. And through the creation, collection, and analysis of relevant data, the IoT facilitates decision-making. With the help of the Internet of Things, devices that were never intended to communicate with one another may now do so in a sophisticated manner. It is predicted by Gartner that by 2020 there will be 26 billion IoT devices in use. The European Commission estimates that by 20204, between 50 and 100 billion devices will be online. In 2008, there were more Internet-connected things than there were humans on Earth[4]–[6].

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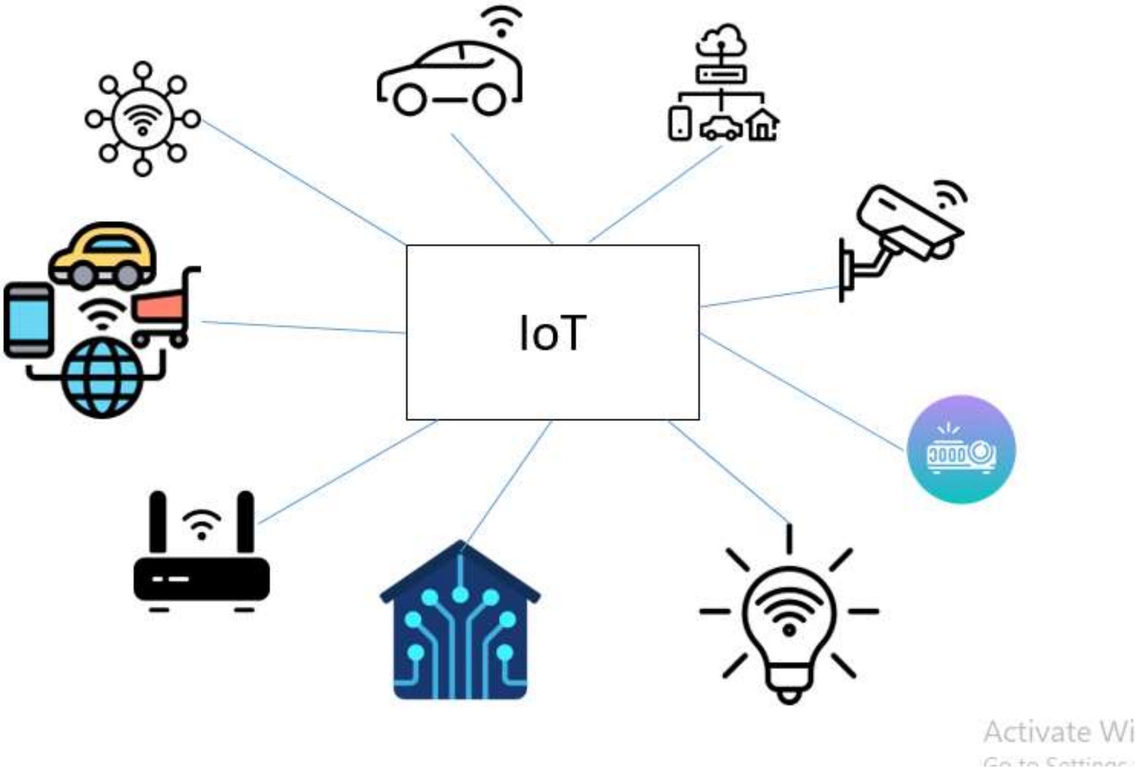

Figure 2: The IoT devices.

The Internet of Things (IoT) links together real-world objects with their digital counterparts, relying on compatible networks and data exchange standards to provide advanced services in the digital economy. Per the European research groupings, the Internet of Things (IoT) is a "self-forming" dynamic global communications transportation system that relies on standard and coherent communication channels, where "things" (both real and imagined) have unique identifiers, characteristics, and personalities; they interact with one another via intelligent interfaces; they are fully embedded in the communications system; and they routinely share data about their users and their environments[7]–[10]. Because today's connectivity is accomplished via the intelligent connection of gadgets, GSMA refers to the IoT as the "Connected Life." The Interconnected Life has a significant effect on our daily lives and the quality of our job, as well as on medical, transit, schooling, and energy consumption. Internet of Things (IoT) is a concept that may be understood by considering the connection between a huge number of devices; nevertheless, this connection is only a facilitator. Data is where the actual value of IoT lies since it is one of the main outputs of the technology. When building a cloud, it's important to think about how you'll monetize things like IoT and big data. Thus, Internet of Things = Father > Big Data = Mother > Sky = Location. We may divide the Internet of Things into three categories, as follows:

The internet allows for three types of communication: (a) between humans, (b) between humans and inanimate objects, and (c) between inanimate objects.

As shown in Figure 3, the ultimate goal of the IoT is to enable items to be connected at any time, from any location to any other object, utilizing any kind of network or service.

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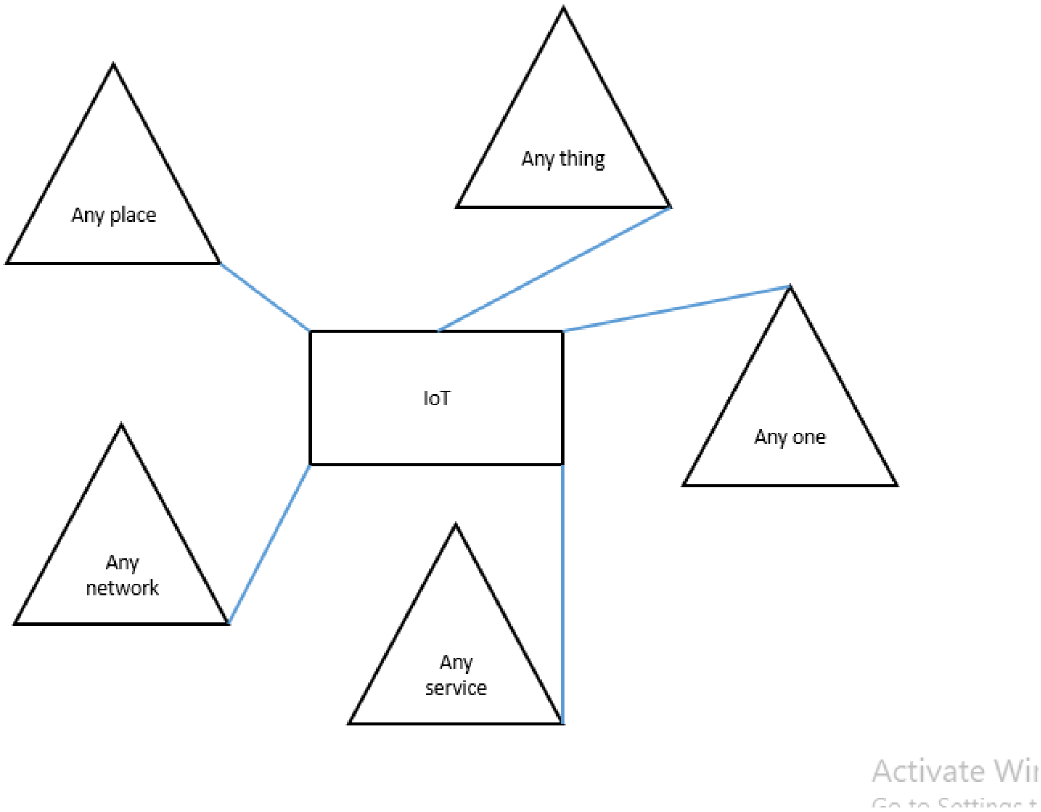

Figure 3: The IoT connectivity perspective.

Since the IoT encompasses much more than machine-to-machine connectivity, sensor networks, home automation, 2G/3G/4G, GSM, GPRS, RFID, WI-FI, GPS, microcontrollers, microprocessors, etc., it is not a technological evolution. These techniques are seen as the enablers that allow for "Iot" implementations[11]–[13].

According to the same three categories seen in previous works, the Internet of Things consists of:

Technology that 1) helps objects acquire context, 2) helps objects comprehend context, and 3) helps protect users' personal data.

The internet of things is not a single technology but rather a combination of several. For the IoT to function, it is necessary to combine information technology (the software and equipment used to save, acquire, and analyze information) with technology[14]–[16].

The following are some of the key characteristics of the Web of Things:

Interconnectivity: 1)Anything may be linked to the global information and communication infrastructure;

2)Services pertaining to things, such as privacy protection and semantic homogeneity between real-world and digitally-connected things;

3) IoT devices are heterogeneous in that they may communicate with one another across a wide range of network topologies;

In terms of dynamic change, we mean the condition of gadgets is always evolving.

5)Huge scope: The number of IoT devices much outnumbers the total number of internet-connected gadgets;

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Protection of sensitive information and users' protection from harm must be prioritized as we design the IoT's safety infrastructure.

To connect or to make a network accessible and compatible.

The following are examples of IoT communication models.

1) Device-to-Device:

Showcase a number of devices that talk to one another directly, without going via a central client machine as in Figure 4. In-home automation, for example, is used for applications that send small packets of data to one another in order to relay commands to various devices (such as the status messages of a door lock or the instruction to switch on a light).

2) Device-to-Cloud:

To exchange data and manage control messages, IoT devices in this architecture communicate directly with an Internet cloud service, such as an application service provider. This strategy makes extensive use of preexisting communications mechanisms to establish a connection between the item and the Internet connection, which in turn relates to the cloud service.

3) Device-to-Gateway:

This concept uses a hardware gateway (ALG) service as a conduit to extend a cloud service to an Internet of Things (IoT) device. The setup involves program software running on a local gateway device that mediates communication between the unit and the cloud service.

Fourth, a model for sharing information in the background:

The term "communication architecture" is used to describe a framework that enables customers to export and analyze computational data from a remote server in conjunction with information gathered from other sources. It also enables the consolidation and analysis of data streams collected from individual IoT devices.

Figure 4: The device-to-device communication.

The Internet of Things (IoT) is a cutting-edge innovation in the field of developing technologies. In spite of the fact that the scientific community knows very little about it, it is finding widespread usage in a variety of applications because of its numerous advantages.

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I. Quality of Service, Rising Revenue: Assist Businesses in Addressing Obstacles to Achieving Their Sales Goals Without Sacrificing Customer Satisfaction (Win-Win strategy). Apps for online clothing stores, for instance, may analyze a user's browsing and purchase habits to tailor recommendations for sales and specials.

II. Task automation: move away from inefficient practices such as lengthy and unsatisfactory customer feedback.

III. Customers to Target: Learn who your most valued customers are based on their interests so you know who to spend your time and energy on. For example, the watch manufacturer may learn from collected data that men in their twenties and thirties who don't exercise frequently are more likely to buy the company's product in an effort to start working out.

IV. Accuracy: Permit tracking and analysis of previously unobservable consumer behavior in relation to services and products (Notice the Unnoticed).

V. Provide real-time interactions with consumers by notifying them of relevant offers, sales, and/or ads through push notifications. Real-time feeds and advertisements are provided by social networking applications, for instance, and are tailored to the user based on their viewing habits, the amount of time spent in a single account, the material they are most interested in, and their search and conversation history.

Among the many branches of cognitive computing, decision-making (DM) is particularly noteworthy since it is the process by which humans pick the most suitable option, or rate the relative merits of many candidates. Several stages are required, including the definition of the issue, the establishment of preferences, the evaluation of potential solutions, and the disclosure of the optimal one. Economic analysis, strategic plans, AI, data categorization, investment choice, prediction, healthcare applications, risk assessment, management of supply chain architectural difficulties, and cognitive problems are all examples of DM's practical uses. In such contexts, decision-maker preferences are seldom quantifiable, stable, and consistent. There is a need for more than what is provided by the memberships of traditional set theory, which are inadequate here. To deal with the ambiguity inherent in mental abilities, Zadeh advocated using fuzzy sets (FSs) with memberships between 0 and 1[17]–[21].

Atanassov (1986) introduced the intuitionistic fuzzy set (IFS) because incorporating fuzziness into DM issues alone is insufficient to address the hesitancy experienced by decision-makers. Every ingredient's degree of non-membership is represented by a number between zero and one. In-Frame Statistics have been widely used to DM issues.

To more precisely represent the uncertainty, Smarandache proposes the neutrosophic set (NS), an expanded and generic variant of the classical fuzzy set and the intuitionistic fuzzy set. Members of the neutrosophic set may either be true (T), indeterminate (I), or false (F). Truth is 0.7, falsehood is 0.4, and indeterminacy degree is 0.2 if an expert is consulted on any assertion. For a neutrosophic setting, the equation might look like this: x (0.7, 0.2, 0.4). These numbers fall into the realm of the intuitionistic fuzzy set, as can be observed. Wang et al. introduced interval neutrosophic sets (INS) and single-valued neutrosophic sets (SVNS) for usage with neutrosophic sets in the sciences and engineering fields (SVNS). In multi-criteria decision-making (MCDM) situations, the SVNS makes it simpler to communicate uncertainty, imprecision, inconsistency, and incomplete data[22], [23].

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The SVNS approach is often used in the research community. ahin and Küçük introduced the idea of a neutrosophic subset as a distance metric for SVNSs. Some of the procedures used in the research by Ye were shown to be unrealistic, and new operators were established, thanks to the work of Peng et al. In the last several years, the machine learning approach has been applied to dilemmas involving choice. In particular, decision-making issues are addressed by machine learning as well as other having-to-learn approaches. Nonetheless, machine learning approaches have drawbacks, such as requiring a new training phase every time and being dependent on the input data. When looking at the existing research using SVNSs, it is clear that the present scoring function and distance metric employed generated incorrectly findings in several instances. In light of this, a novel scoring system and distance measure were created for this investigation.

Since renewable energy (RE) options have grown more and more popular in recent years owing to their clean, eco-friendly, and ego structure, rating the RE alternatives or prioritizing RE alternative issues has become rather ubiquitous as an essential and innovative DM problem. The difficulty of choosing amongst potential courses of action in RE has been the subject of several MCDM approaches. An MCDM framework for the dissemination of renewable energy technology was presented by Beccali et al. As an example, Polatidis et al. use MCDM methods to provide a framework for RE planning. Kaya used a framework on the AHP to determine the most effective RE sources for Istanbul, whereas olak employed an MCDM model built on the fuzzy TOPSIS to rank RE sources in Turkey. As can be observed, there is no research on neutrosophic set prioritizing for RE alternatives. However, Olak and Kaya claimed that the VIKOR technique is a potentially helpful approach that has been understudied in the research. They also mentioned the VIKOR technique for further research on this issue. Serafim Opricovic introduced the VIKOR technique in 1998, and research by Opricovic and Tzeng in 2004 established its use in the resolution of multicriteria decision-making issues. Considering all of the feasible options, a middle ground is found that best approximates the optimal outcome. This shortcoming in the existing literature may be remedied using neutrosophic values and the VIKOR approach to the RE option choice issue, leading to more precise outcomes. Figure 5 shows the framework of this study.

This research, however, focuses on the impact of IoT in the classroom and on effective decision-making more generally. The information collected by IoT devices may be used to create a more secure and supportive learning environment for students. Large sums of money are needed to purchase IoT devices, but the potential future advantages may be worth the initial outlay. It not only provides the most beneficial learning environment for pupils, but it also reduces expenses. Therefore, using IoT in the classroom is akin to riding a wave of change that carries new possibilities for bettering the classroom experience.

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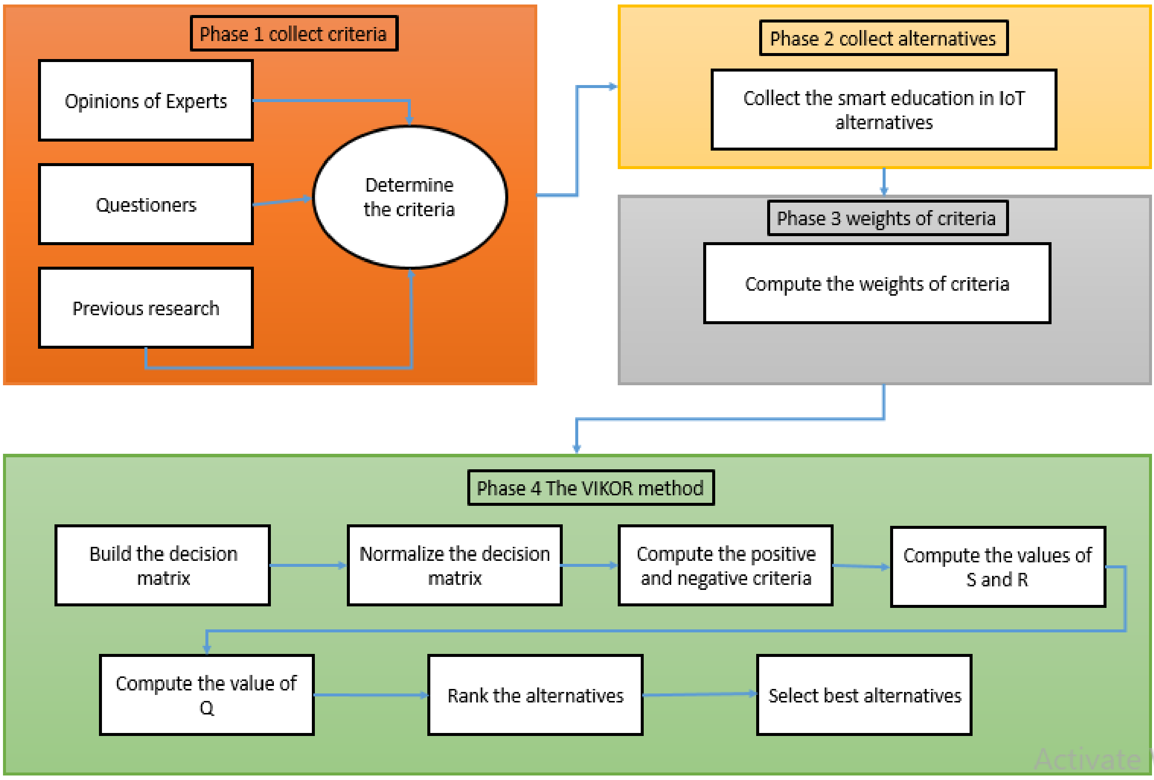

Figure 5: The framework of this study.

2. Smart Education

A cohesive and thriving concept of "smart learning" has yet to emerge. In its broadest sense, the phrase "smart education" refers to a novel approach to education that legitimizes and simplifies the whole educational procedure and credentialing in the information age. The English acronym SMART is broken down into its component parts (S = self-directed, M = motivated, A = adaptable, R = resource-enriched, and T = technology). Smart learning is "an emerging topic alongside other relevant developing applications such as smart computing, smart instruction, smart education, intelligent, smart glasses, smart institutions, and smart society," according to the International Association for Smart Learning Environments (IASLE). Recent years have seen a rise in interest in the notion of "smart education" among today's educators. Thus, from the viewpoint of the education sector, the phrase "smart education" often refers to a variety of actions, including those that are interactive, adaptive, and scalable. To be more specific, smart education is able to provide a personalized and tailored knowledge service, such as awareness of context, deduction of logical reasons, effective adaptation, precise sensing, telemonitoring, collaborative practices, self-learning, team-based learning, interactive educational activities, logic awareness, personality with confidence, rapid evaluation, and genuine feedback, to involve and start engaging the learner in an active, effective, skilled, and receptive manner. The advantages, disadvantages, and potential solutions of smart learning gateways for universities to use educational technology were explored by Alajmi et al, with a focus on universities in the Sultanate of Oman. A similar disparity between schooling and job experience is recognized by Aker and Herrera in another recent research. Smart pedagogy is presented as a viable solution to this problem, and the supporting reasons are laid forth. This is reinforced by providing an example of a smart pedagogic cooperative cloud, a novel educational process that may serve as a link between an internet issue service-learning instructional method and the cloud. Evidence from a variety of research shows that the online educational setting, or "smart education," greatly contributes to shaping the learner's performance qualities, like predisposition, character, temperament, and inventiveness, in higher education. Smart school institutions, smart learning gadgets, and smart pedagogical technologies are just a few examples of the significant scientific and technical developments that have made it easier to keep a productive and healthy learning environment at all levels of schooling. Recent advances in smart learning environments provide substantial aid to students and learners by way of novel methods, learning

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technology, knowledge construction, and learning strategies. The primary goal of smart learning is to provide students with the knowledge and tools they need to adapt to the complexities of the contemporary world and succeed in their chosen fields. In addition, students benefit from a learning process that is completely contextualized to help them in their unique learning, housing, and working settings, thanks to the use of such methods. This novel contextualized learning method provides students with the opportunity to solidify their abilities, enhancing the overall quality of their education. Smart learning ecosystem (SLE) models inform the top-level standardizing systems.

3. Proposed Methodology

Making the right choices is crucial to management since the effects of such choices might range from negligible to catastrophic. The judgment is a free-willed choice from which subsequent actions may be derived. DSS, or Decision-Support Systems, refers to any kind of software that uses data to help with decision-making and provides support for judgment. The software models are used to estimate data from a number of sources. Data flows like these are always sourced from databases and provide outcomes, say, in the form of a report designed with the user in mind. Analytics may be defined as the use of algorithms to make choices based on numerical models, historical data, lessons learned, forecasts, and quantitation. Based on IoT principles, the term "real-time analytics" is used to describe the software used for data analysis. There have been two significant eras in analytics. The primary focus throughout the first time period was on consolidating and organizing internal data. Big data's upward trajectory shaped the second time period. There has been a proliferation of new methods, categories, and the incorporation of external data over this time. The improvement of business operations and choices of any sort may be directly attributed to the processing of data to statistics. This can be a time- and energy-saver. And with all the data you're collecting via IoT, you can finally get your job done the way it should be done. In order to be really analytical, the algorithm at the heart of the program must be able to tell good data from bad. Consequently, the cornerstone for making good selections in the modern day is the reliable source of information. After that, we offer a method for arriving at accurate decisions as shown in Figure 6 owing to the importance of information and facts in making effective and correct choices.

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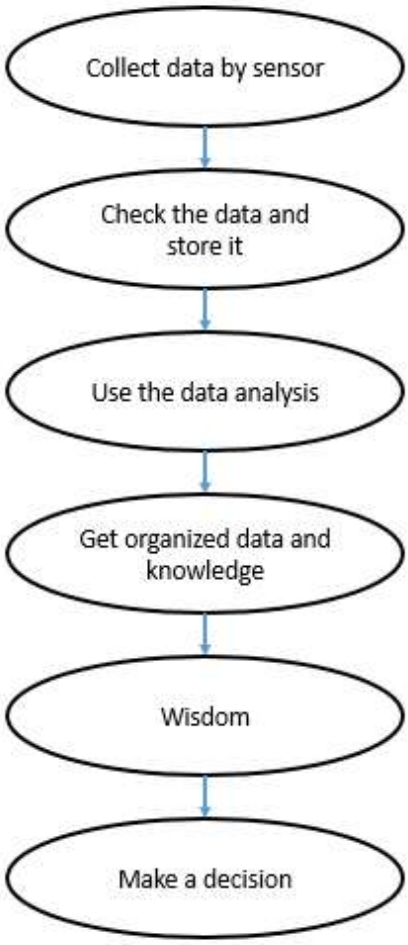

Figure 6: The decision based on IoT and IoB.

Definition 1:

Consider the discourse universe $X = x1, x2, \dots, xn$, where A is an SVNS. A is characterised by three membership functions: truth (TA(x)), indeterminacy (IA(x)), and falsity $(FA(x))\ (x)$. Any subset of [0, 1+] for which the X functions TA(x), IA(x), and FA(x) hold is either real or real-not-standard. That is, $TA(x), IA(x), and\ FA(x)$ are all true if and only if x is in the interval $[0, 1+]$. To put it another way, if 0 sup $0 \leq TA(x) + sup\ IA(x)A + sup\ FA(x) \leq 3+$, then TA(x), IA(x), and FA(x) are all equal.

Definition 2:

Take X to be some kind of theoretical space. An object of the type is a one-valued neutrosophic set A over X.

Where $uA(x) : X\ [0, 1], rA(x) : X\ [0, 1], and\ vA(x) : X\ [0, 1], and\ 0 \leq uA(x) + rA(x) + vA(x) \leq 3$ for all x X. Degrees of truth membership, indeterminacy membership, and falsity membership of X to A are denoted by the intervals aA(x), bA(x), and cA(x), respectively.

A SVN number is written as $A = (a, b, c), where\ a, b, and\ c$ are integers between 0 and 1 and 0 and b and c are positive integers, and 3 is the largest possible sum of these three.

Definition 3:

To define the sum of two SVN integers, let's say $A1 = (a1, b1, c1)\ and\ A2 = (a2, b2, c2)$.

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$$A1 \oplus A2 = (a1 + a2 - a1a2, b1b2, c1c2)$$

Definition 4:

Consider two SVN numbers, A1 and A2, where $A1 = (a1, b1, c1)$ and $A2 = (a2, b2, c2)$, respectively.

$$A1 \otimes A2 = (a1a2, b1 + b2, c1 + c2 - c1c2)$$

Definition 5:

If we define an SVN number $A = (a, b, c)$ and a positive real number R at random, we get:

$$\lambda A = (1 - (1 - a)^{\lambda}, b^{\lambda}, c^{\lambda}), \lambda > 0$$

Definition 6:

Any SVNS A has a complement, indicated by Ac, which is defined as $a_A^c(x) = c_{A(x)}, b_A^c(x) = 1 - b_A(x), and\ c^c A(x) = aA(x)$, where x is a number in X. Then

$$A^c = x, c_A\ (x), 1 - b_A(x), a_A(x)\ |x\ \in X|$$

Definition 7:

The set of n SVN numbers is denoted by $[A1, A2, A3, \dots, An]$, where $Aj = [aj], [bj], and\ [cj]$ for any $j\ in\ [1, 2, \dots, n]$. We find a definition for the neutrosophic weighted average operator with a single value:

$$\sum_{j=1}^{n} \lambda_j A_j = \left(1 - \prod_{j=1}^{n} (1 - a_j)_j^{\lambda}, \quad \prod_{j=1}^{n} (b_j)_j^{\lambda}, \prod_{j=1}^{n} (c_j)_j^{\lambda}, \right)$$

The VIKOR method

In 2004, Opricovic and Tzeng were the first to publish the VIKOR technique. The method's foundational idea is focused on weighing competing criteria to determine which option is best. The approach's goal is to arrive at a mutually agreeable resolution during the vetting phase. Viktor's central idea is derived using the Lp measure.

In multicriteria decision-making situations, extracting a decision matrix from the combined decision matrices provided by many decision-makers requires first determining the weight values of the decision makers involved. In this work, we offer a different approach to determining weights, one that makes use of recently discovered metrics of the distance between SVNSs.

$Let\ XT = (xtij)$ be the t-th decision maker's decision matrix, where $xtij = aijt, bijt, cijt\ is\ an\ SVN\ number$, n attributes, m choices, and t decision makers.

It is possible to get the X ideal matrix of all matrices used by decision makers by solving for $(xij), where\ xij = aij, bij, cij$. Here, the average operator is used to determine xij. Therefore, xij is a version control system number.

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The following method is used to determine the importance of each stakeholder in the decision-making process.

The closer Dt's option is to the optimal one, the more weight it is predicted to carry.

Suggested new distance metric, we can figure out the similarity measure seen between the decision problem of Dt and the ideal matrix analysis:

$$S(X^t, X^*) = \frac{d(X^t, X^{c*})}{d(X^t, X^*) + d(X^t, X^{c*})}$$

Then, the following expression may be used to determine the influence of group t, where $t = 1, 2, \dots, k$.

Every decision maker has their own set of priorities when it comes to weighing the criteria. As a result, it is necessary to create a unified set of weights of factors by summing up all the weighting factors of the experts.

Recent years have seen widespread use of entropy across a variety of decision-making processes. One of them is the determination of criteria weights. It assigns a criterion's weight only on the basis of its differences from other criteria, with no other, more qualitative data being taken into account. A high entropy value for a criterion indicates that it contributes less information and should be weighted less heavily than other criteria.

Here, we apply the conventional VIKOR model to the SVN sets, finding the positive Wj values for all j ($j = 1, 2, \dots, n$) criteria, and the negative Wj values for all j ($j = 1, 2, \dots, n$) criteria.

$$a_j^{W+} = \max_i a_{ij}^W, \min_i a_{ij}^W,$$

$$b_j^{W+} = \max_i a_{ij}^W, \max_i a_{ij}^W,$$

$$c_j^{W+} = \max_i a_{ij}^W, \max_i a_{ij}^W,$$

$$a_j^{W-} = \max_i a_{ij}^W, \max_i a_{ij}^W,$$

$$b_j^{W-} = \max_i a_{ij}^W, \max_i a_{ij}^W,$$

$$c_j^{W-} = \max_i a_{ij}^W, \max_i a_{ij}^W,$$

$Si \text{ and } Ri \text{ values for } I = 1, 2, \dots, m)$

The utility index may be computed as

$$S_i = \sum_{j=1}^{n} \frac{W_j^+ - W_{ij}}{W_j^+ - W_j^-}$$

$$R_i = \max_j w_j \ \frac{W_j^+ - W_{ij}}{W_j^+ - W_j^-}$$

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as a ith possible interpretation. The importance of the jth criteria is denoted by wj in this formula. We use $W + j, Wj$, and the suggested new distance function to define the Si and Ri in the neutrosophic setting.

Qi Index Value Determination

The index value Qi I = 1, 2,..., m) may be expressed as

$$Q_i = \gamma \left[\frac{S_i - S^+}{S^- - S^+}\right] + (1-\gamma)\left[\frac{R_i - R^+}{R^- - R^+}\right]$$

Here, we have S+ = minimum Si, S = maximum Si, R+ = minimum Ri, and R = maximum Ri. Maximum group benefit weight is expressed as and is equal to, where, is the weight of the least regretful alternative set of values. In this investigation, we take it to be 0.5.

Ordering the alternatives

The options $A1, A2, \dots, and\ Am$ are ranked by creating a decreasingly ordered list based on $Qi, Si, and\ Ri\ I = 1, 2, \dots, m$).

4. The Application of the VIKOR method

Using IoT and IoB in educational institutions has several benefits, including encouraging more thoughtful lesson planning, keeping tabs on crucial resources, improving access to information, designing safe campuses, and much more. The Internet of Things (IoT) and IoB may be seen as novel methods for managing the classroom using newly created instruments.

The most well-known IoT and IoB that have shaken up the textbook industry are as follows(Alternatives)

i. 1)Interactive whiteboards;
ii. 2)Mobile and tablet apps for teaching;
iii. 3) Smart digital boards. The greatest approach to study is introduced in
iv. 4)electronic books;
v. 5)other learning sources, like Google Apps, which allow students and instructors to collaborate on a document in real-time in a web-based environment;
vi. 6) Eighth-anytime, anywhere learning,
vii. 7) seventh-improvements to communications, and
viii. 8) Seventh-wireless door locks.
ix. 9) Temperature monitors; and
x. 10) Attendance monitoring systems are all examples of advanced security precautions.

There are a number of obstacles to using IoT and IoB in classrooms (criteria).

I. The security and privacy of students are compromised because IoT devices collect and record data about them and store it on a network connected to the Internet.
II. Connectivity stability: There is a continuing need for cutting-edge educational technology like wireless networks that provide the capacity for multimedia lectures.
III. Thirdly, there is the difficulty of management; in order to successfully integrate IoT in a progressive manner, a school or other educational institution has to guarantee that its teachers and students have access to the necessary IT resources and instructional strategies.
IV. Using Internet of Things (IoT) gadgets at educational institutions might be expensive, which presents a further obstacle.

Here, we apply the neutrosophic-VIKOR technique to smart education in IoT and IoB, which we suggest as a solution to the decision-making challenge stated. four parameters and ten options were established for the very broad assessment issue. An overview of the study's underlying model, as seen in Figure. 7.

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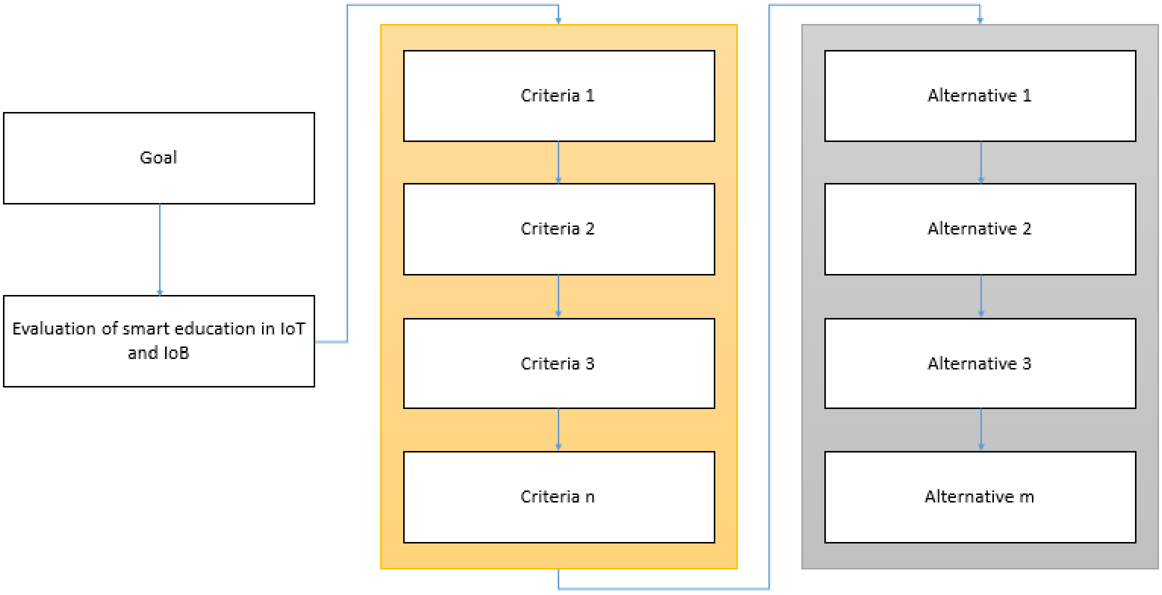

Figure 7: The structure model.

When faced with a choice, people often use a mix of definite and nebulous values to communicate their preferences. As a result, phrases and sentences may be used in place of raw integers as scaling values. A linguistic scale is more adaptable and relevant than a numerical net scale. We compute the weights of criteria by the opinion of the experts as shown in figure 8.

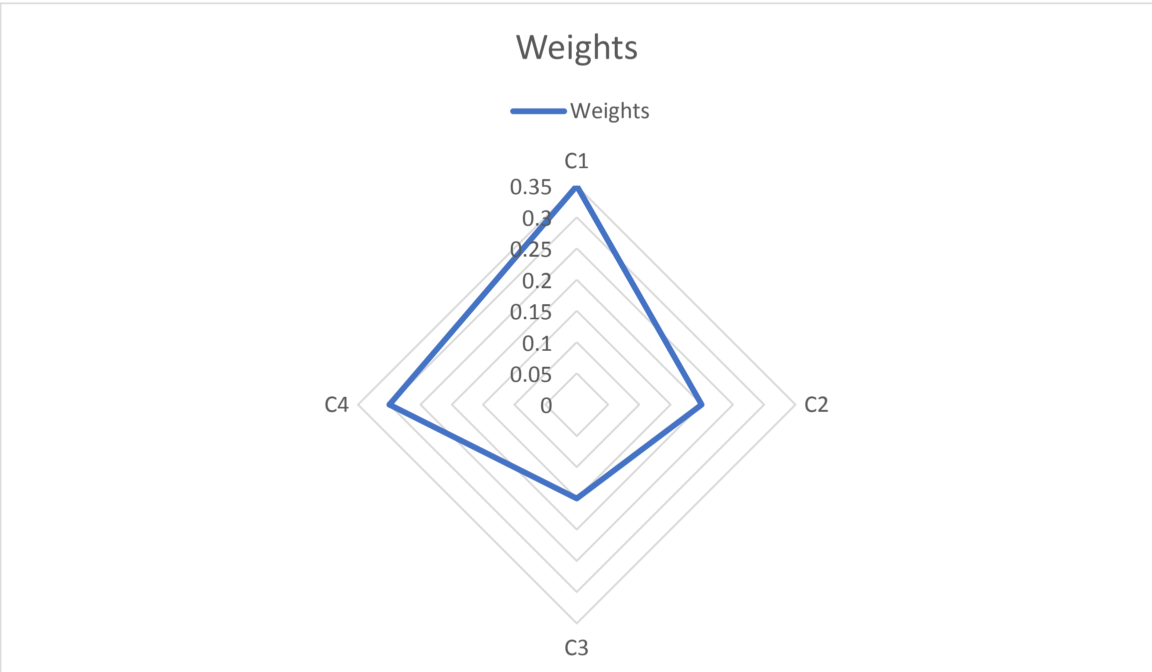

Figure 8: The weights of criteria in this study.

Using the aforementioned lexical items, we polled four experts for their input and generated the decision matrices shown in Table 1.. Table 1 uses four criteria Ci(i)(i = 1, 2, 3, 4,) and ten options $Ai(i = 1, 2, 3, 4, 5)$. All these criteria represent profitable outcomes, except cost represents cost

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criteria. Then the weighted normalized decision matrix is computed in table 2. Then compute the values of the S, R, and Q in table 3. Then rank alternatives as shown in figure 9.

Table 1: The decision matrix is based on the opinions of experts.

	C1	C2	C3	C4
A1	0.8	0.4	0.6	0.477778
A2	0.583333	0.6	0.8	0.4
A3	0.372222	0.316667	0.6	0.666667
A4	0.455556	0.361111	0.533333	0.505556
A5	0.533333	0.716667	0.8	0.4
A6	0.8	0.4	0.533333	0.588889
A7	0.611111	0.8	0.6	0.322222
A8	0.561111	0.677778	0.544444	0.705556
A9	0.361111	0.505556	0.6	0.744444
A10	0.8	0.4	0.372222	0.45

Table 2: The weighted normalized decision matrix.

	C1	C2	C3	C4
A1	0	0.082193	0.050311	0.066934
A2	0.053628	0.041096	0	0.086456
A3	0.105881	0.099316	0.050311	0.019522
A4	0.085254	0.090184	0.067081	0.059962
A5	0.066004	0.017123	0	0.086456
A6	0	0.082193	0.067081	0.039045
A7	0.046752	0	0.050311	0.105979
A8	0.059128	0.025114	0.064286	0.009761
A9	0.108631	0.060503	0.050311	0
A10	0	0.082193	0.10761	0.073906

Table 3: The values of S, R, and Q

	S	R	Q	Rank
A1	0.456364	0.082193	0.467316	8
A2	0.480523	0.0974	0.6603	4
A3	0.524	0.105881	0.794631	3
A4	0.719817	0.102089	0.926242	1
A5	0.372338	0.086456	0.440571	9
A6	0.607668	0.107374	0.885969	2
A7	0.284621	0.105979	0.582589	5
A8	0.15829	0.064286	0	10
A9	0.219444	0.108631	0.554454	7
A10	0.263709	0.10761	0.582355	6

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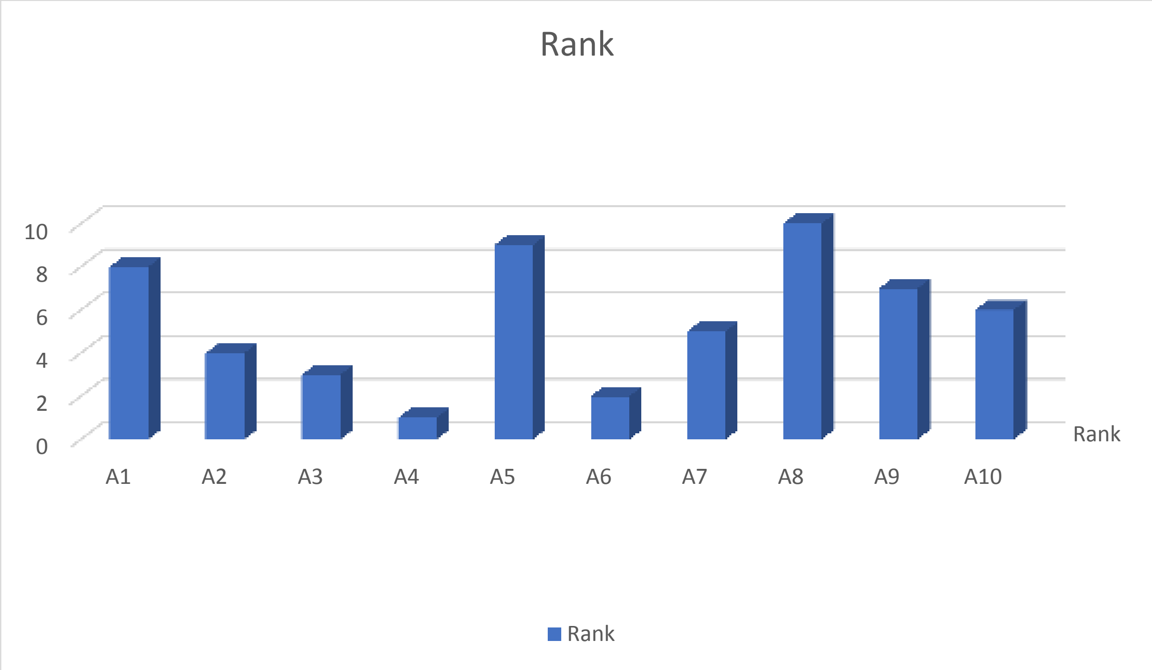

Figure 9: The rank of alternatives.

6. Conclusion

The Internet has profoundly affected our way of life, enabling us to engage in lively, virtual interactions with others in a wide range of settings, from corporate to personal. The IoT makes it possible for connected devices to exchange data with one another at any time, from any location, and with any other device. To achieve this goal, we demonstrate why IoT should be considered an integral element of network design as a whole. Smart buildings, smart grid, internet of vehicles and movement, smart homes, smart factories and production, health, education, and farming are just some of the areas that might reap the rewards of the Internet of Things. This research, however, focuses on the Internet of Things (IoT) function in the classroom. The use of the Internet of Things (IoT) and IoB technology in the field of education has sparked the development of novel and ingenious strategies for the benefit of both students and educators. In addition, IoT and IoB have helped the education sector overcome its problems by reducing expenses, improving management, and bolstering safety. We also have offered a foundation on which to build effective judgments, since we recognize the importance of doing so and the permanence and breadth of the range of effects that may result from poor judgment. We propose new models that will enable the use of IoT and IoB in crucial industries like healthcare and agriculture in the near future. We will include all colleges and universities in this study.

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