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Decision Support System

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Abstract. Decision support system (DSS), often known as an collaborative computer application which is also known as an informative system, which helps in decision-making and, occasionally, it also manages the knowledge. Corporations, associations, and organizations must be determined to disclose details about the subject enterprise to the assessment-making process. Along with this, businesses consult DSS tools, methodologies, and models for guidance on their operational and strategic decisions. One of the systematic ways to collect information about the options available to individuals and organizations in the process of making strategic decisions is the decision-making process. Companies want to be aggressive and make powerful choices to attain their target. Strategic Information Systems Planning (SISP) and Decision Support Systems (DSS) make a contribution to those efforts. Healthcare, Education, Agriculture are the fields where Decision Support Systems can be used. Here we have described Decision Support System into broad classification i.e. components, types, characteristics and important aspects of Decision Support System. The algorithms which are used by affection DSS are neural networks, logistics regression , classification trees, fuzzy logic, Genetic algorithms.

Keywords: DSS, *decision-making, Education, Healthcare, Agriculture*

A. INTRODUCTION

User get the inclusive information report which is analyzed and collected by the Decision Support System. Different kind of requisition that is help to make decisions is called as Decision support system .The development of such systems dates back to the middle of the 1960s.People have different perspectives on how the DSS field operates. Multiple frameworks were employed by researchers to construct and comprehend these systems. The main five classification of DSS are as follows: - communications-driven, data-driven, document-driven, knowledge-driven, and model-driven decision support system. Researchers have conducted a systematic study of the use of quantitative computer models to support planning and decision-making since the 1960s..Ferguson and Jones in 1969, experimented with the first ever study of computer-based decision making systems .Scott Morton (1971) scrutinize how analytical models and computers could assist managers in regularly making important company planning decisions. He carried out an experiment in which Management Decision Systems were actually employed by managers (MDS). Studies based on Management Decision System, Strategic Planning System, Decision system began to be published in Business Journals in 1970.Gorry and Scott-article Morton's from 1971 introduced the term "Decision Support System" for the first time. There was argument that Management Information System main focus was on structured decision and Decision Support System unstructured and Semi-Structured System should also be known. Here is the history of the Decision Support System.

Knowledge base, Software and User Interface are the three significant Decision Support System components.

A knowledge base, which includes data from internal and external sources, is a crucial component of a decision support system database.

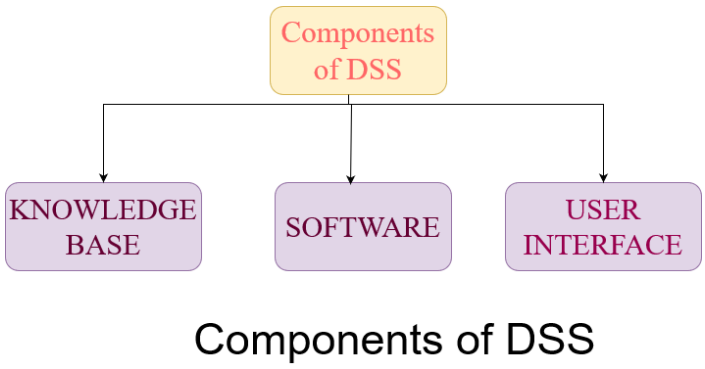

Figure 1:- Components of Decision Support System

A knowledge base is a crucial part of a decision support system database because it incorporates data from both internal and external sources. The software system is composed of various model management systems. A model is a computer simulation of an actual system that shows how it works and offers recommendations for how it could be made better. The user interface of the system is easy to navigate. Making it simple for the user to access and edit the data stored on a decision support system is its main objective. There are five different species of decision support systems: document-

driven, knowledge-driven, communication-driven and group, and data-driven. A computer programme that bases its choices on information from either an internal database or an external database is known as a data-based DSS.Model-based decision support systems can be modified to help with scenario analysis and are created to match the unique demands of users. Communication-based decision support systems employ a variety of communication techniques to encourage more individuals to work on the same activities. Data that is continuously updated and maintained by knowledge management systems serves as the foundation for knowledge-based decision support systems. A records management system called a document-based DSS exchanges data via files. Framework-based taxonomies include text-oriented, database-oriented, spreadsheet-oriented, solution-oriented, grammar-oriented, and composite taxonomies.

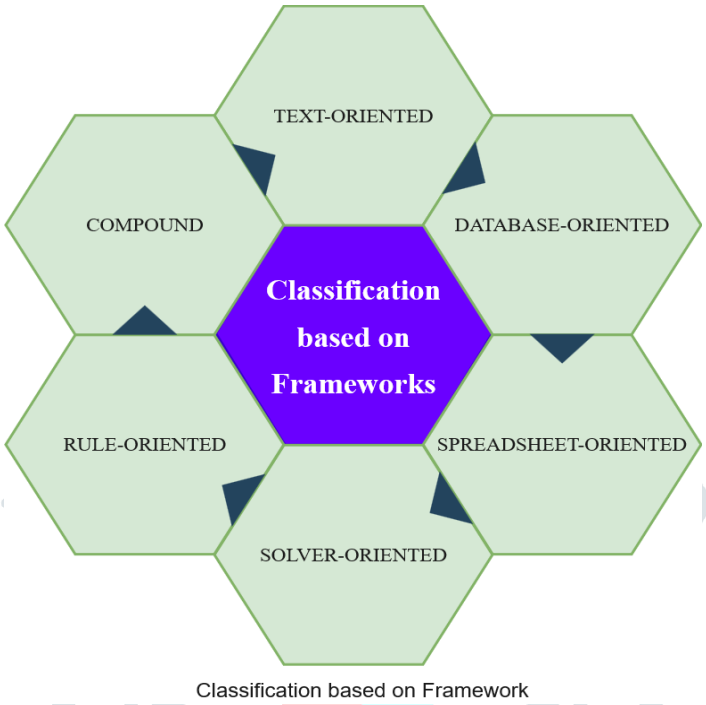

Figure 3:- Classification of DSS based on Frameworks.

Text DSS contains text information that allows you to create, evaluate, and display documents electronically as needed. Database-based DSS is based on a structured and highly structured database. The DSS spreadsheet includes spreadsheet information. Spreadsheets make it easy to create, view, or modify software knowledge. You can also train the machine to execute commands on its own. Solver-oriented DSS is based on algorithms or programs created to perform specific calculations and execute certain types of programs. Rules-based DSS follows certain rules-like steps. The most typical DSS categorization is composite DSS.It is an associative system with two to five fundamental building blocks.

B. LITERATURE REVIEW

To briefly study the Decision support system, we reviewed articles and journal articles.

One of the most essential resources for living is water, so it's crucial to make wise management selections. Decision support systems (DSSs) are given sophisticated solutions by evolving technology. The number of DSSs created for managing water resources has grown dramatically over the past few decades, making computing systems even more sophisticated as water management procedures, Internet of Things (IoT) sensors, and multi-criteria judgments become a big game. Involving multiple stakeholders within the decision-making process is critical to the success of DSS, because it facilitates the analysis of approaches from different domains. Finding an inexpensive balance within the management of water resources requires achieving several goals in numerous areas. This text aims to provide a summary of technology development and integration to worry socio-economic benefits (Diana-Andreea Arsene etl, 2020, June)

Explains the advantages of creating a knowledge mart to design and deploy a choice network. Users can readily use data marts as a place to store and partake in data to support their higher cognitive function. Harmonious possibilities are required to induce data in an incredibly successful method due to the issues with the knowledge and Communication Society systems outlined. The benefits of developing and integrating constructing data marts, as well as the distinctions between them and relational databases, are thus discussed, along with a proposed architecture for decision support systems inside the general public transaction information and communications society to perform and to cause information with four levels.(The information source is determined by the interface layer, the design process for the SQL Server integration service is determined by the extraction transformation load layer, and the star schema compliant data mart is determined by the information mart layer. thus, the presentation layer chooses the system's outcome.).(Refed A. Jaleel etl, 2020, June)

Critically evaluate the depth and approach of DSS research. The history of DSS is used to analyze the development of several subsets of research and practice, such as personal DSS, group support systems, negotiation support systems, intelligent DSS, management DSS knowledge, management information systems, etc. Prioritize business intelligence and data storage. You can learn more about the most recent DSS studies by reading an empirical review of published DSS studies. Major journals from 1990 to 2003. The analysis shows that since peaking in 1994, DSS circulation has steadily declined, with current circulation rates roughly comparable to those of the early 1990s. DSS The least open is the data warehouse, others say, while group-enabled systems and individual SSDs dominate research operations. DSS Magazine is a remarkable publication.

European journals hardly ever use DSS, but the majority of DSS is published in US "other" journals. About two-thirds of DSS surveys are empirical, compared to one-third of regular IS surveys. Positive thinking characterizes the vast majority of empirical DSS studies, and these studies are more positivist than general IS studies. A significant area of study in DSS is design science. Focusing on decision support in a model environment balances research on development, technology, procedure, and outcomes. The majority of the cited books are rather out of date, and nearly half of DSS treatises do not make reference to perception and governance in project layout and survey.(David Arnott etl,2016, January)

DSS is hardly ever used in European journals, whereas the majority of DSS is published in US "other" journals. About two-thirds of DSS surveys are empirical in comparison to typical IS surveys. The majority of empirical DSS studies are positivist, and they lean more toward positivism than standard IS studies. Design science is a prominent topic of study in DSS. By focusing on decision support in a sample context, it is demonstrated that a well-balanced approach to development, technology, process, and outcome research is used. Approximately half of the DSS treatises do not include references to judgment and decision-making in their project design and analysis, and the majority of the books mentioned are somewhat out of date..(Mário Ferreira etl, 2015, July)

Decision support systems have been developed by information systems engineers and researchers for almost 0 years (DSS). Model-based DSS is the starting point of this article in the late 1960s, followed by the conceptual development of DSS in the 1970s and its implementation in short- and medium-term financial planning systems, DSS spreadsheets and the DSS collection. , OLAP, and business intelligence. From the mid-1990s to the present, knowledge-based DSS and web-based DSS marked the end of research. (Chai Zhengmeng etl, 2011, December)

ARCHITECTURE

The architecture of a decision support system has four key components.
Following are them:-

1. Language system (LS)
2. Knowledge system (K)
3. Presentation system (KS)
4. system for processing issues (PPS)

The top three systems are representative. The language system contains all of the communications that the DSS can accept. The presentation system contains every communication that DSS is capable of sending.
DSS is in charge of maintaining the knowledge system, which consists of all knowledge saved. These three distinct system types cannot function either individually or jointly. They convey the idea that something is crazy or pointless. Knowing a message that can be sent or an expression that is gathered for additional processing is all that is required. KS, LS, and PS are the core parts of DSS even though they are representative systems. The problem management system, the fourth component, uses each. This system is an active component of the DSS.
DSS software is a problem-solving system.PPP, as the name implies, seeks to identify and resolve problems (i.e. process problems) in decision making.

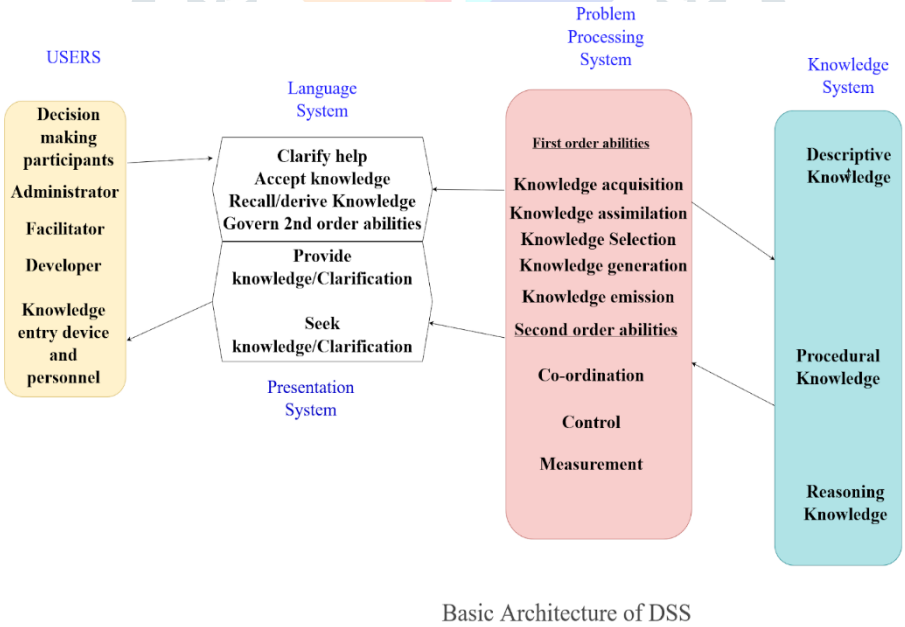

Figure 4:- Basic Architecture of decision Support System

Figure 4 shows how the four DSS subsystems relate to each other and to DSS users. Users frequently make decisions or participate in decisions made by others. However, a DSS user can also be a DSS administrator, developer, or data entry person or device. In each situation, the user chooses the desired LS component and submits a request to the DSS. This could be a request to acknowledge, define, and settle a prior request or response. Identifying difficulties might be difficult for decision-makers, etc. The PPS will be executed when asked to handle a certain LS item. The PPS must choose a portion of the KS material, obtain additional information from an outside source (such as a user), or create new knowledge in order to complete this procedure (selected with 166 Clyde W. Holsapple) may apply the learned information).It includes the mechanism for changing the knowledge kept in the KS by incorporating newly created or acquired knowledge. By choosing the PS item to present, PPS can respond to the user. As a result, while some PPS activities are transparent to users (as evidenced by the PPS emission of PS elements), others are hidden (strictly internal and bring knowledge assimilation to KS). It's not necessary for the problem-solving mechanism to be responsive. In other words, it's not necessary to create behavior that reacts to user requests. Events discovered inside or outside the DSS may start PPS action (Holsapple1987). For instance, certain modifications to KS content may result in covert or overt PPS behavior, such as: B. Inform users that they must make choices

.PHASES

The phases of Decision making consist of four main phase's .They are as follows:-

1. Intelligence
2. Design
3. Choice
4. Implementation

1) Intelligence

This stage entails keeping an eye on the issue and recognizing it, as well as tracking its progression and verifying its reception, processing, and data entry.

2) Design

This research, development, and evaluation of potential alternate courses of action are complete. This phase requires comprehension of the following: Problem reduction, solution development, and solution testing.

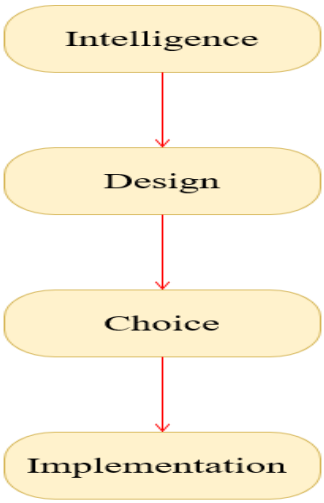

Figure 5:- Phases of Decision Support System

3) Choice

These steps involve several selection procedures. There are other options you might consider.

4) Implementation

The decision-making process then incorporates the election results. Simone serves as a model for demonstrating the role that management systems and Management Information Systems (MIS) play in the decision-making process.

ALGORITHMS

Algorithms used in Decision Support System are K-mean Clustering Algorithm, neural networks, fuzzy logic, Naive Bayesian, LDA Classifier, K Nearest Neighbor, Decision Tree.

. *K- Nearest Neighbor*

K Nearest Neighbor (KNN) falls within the species of classification used by courts. Use a distance function or a similarity function to express known examples to categories unknown occurrences. Calculate the distance between the unknown class item and the known exercise data to find the instance space's closest neighbor, and then select the class with the lowest value as the most prevalent one. The K nearest neighbors are counted first in a KNN. Determine the separation between the training sample and the input data. Here, we calculate the distance using the Euclidean method. After that, ascending order is used to sort the estimated distances. The minimal distance K^{th} is used to identify the neighbor who is closest. Designate the most common class of the nearest neighbor group using the simple majority as the input data class. Euclidean Distance formula is

$$Distance(X, Z) = \sqrt{\sum_{i=1}^{n} (x_i - z_i)^2}$$

Where

x_i denotes the variable in training set

z_i denotes the variable in input set

B. Naive Bayes Classification

A Naives Bayesian classifier assumes that the influence of the values of one predictor for a given class does not depend on the values of other predictors. A Naive Bayes equation calculates the posterior probability of each class. An input class is a class with high probability values. Maximum posteriori hypothesis is

$$P(X) = \frac{P[C] * P[C]}{P[X]}$$

Where
X denotes the instance,
C denotes the class value for instance.

C. Neural Networks

Similar to how a person's biological nervous system processes their brain, artificial neural networks are used to process information.
An illustration of a typical neural network is shown in Figure 5.Send the neural network's first layer the input layer. The output layer, the final layer, predicts classes. Between the input layer and the output layer, there is a hidden layer. The Back Propagation Neural Network (BPN) technique is a crucial tool for ANN training.

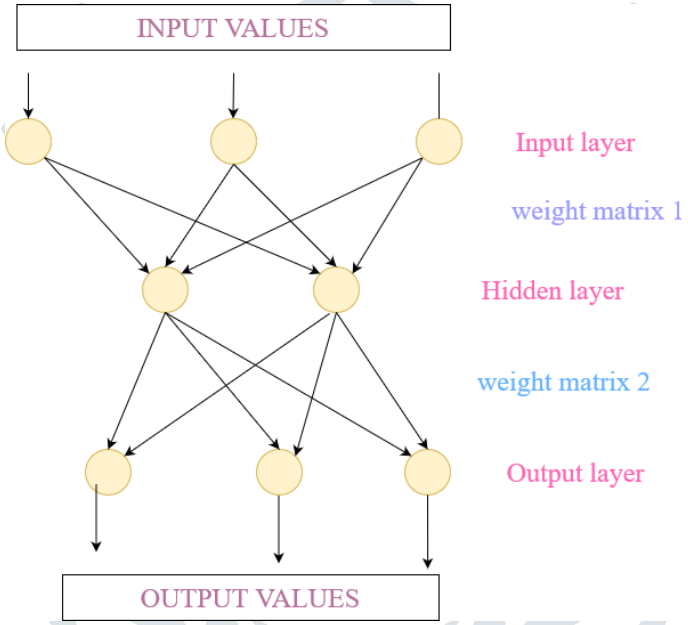

Figure 6: A Neural Networks

It consists of many interconnected neurons that work together to solve a specific problem. For prediction and classification, BPN uses a multi-layer architecture. The numerical weights of the class connections can be modified so that the system can learn from experience and adapt to unknown and expected inputs. Typical exercises can be done by changing the weight.

D. Decision tree

A decision tree is used as a flowchart showing the possible outcomes of particular data. In a decision tree, leaf nodes are the possible ways or number of possibilities of a root node. Results are based on the leaf node test. Taxonomy rules are paths from root to leaf. The final decision is represented by a leaf node. Greedy recursive search is performed by a decision tree based learning algorithm to come up with the best decision tree and generated node. Attribute selection method is used in the data set to obtain the appropriate separation criteria in order to divide the sample data into individual classes. These separation criteria are used to label the nodes. Enable a valid and multicast split if the split attribute is discrete, then remove the split attribute Split the sample data into subtrees for each split. Attach the generated decision tree to the generated node for each data sample in the dataset that satisfies the result. Decision trees are used to solve tree classification and regression problems by dividing large amounts of data into smaller data sets (numbers and categories) that are displayed in the decision node.

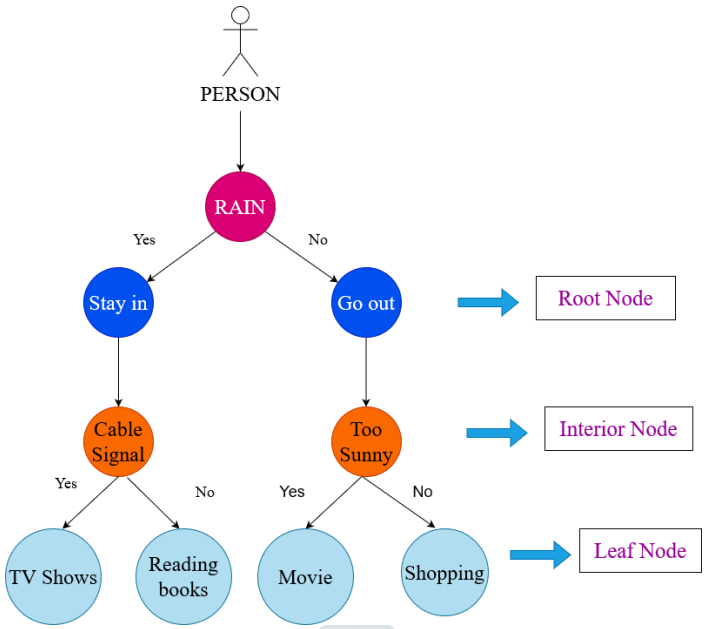

Figure 7:- Working of Decision Tree Algorithm

How the decision tree algorithm is implemented while taking a decision i.e. shown in the Figure 7. In figure 7, a person is making the decision Based on the condition of rain. If it is raining, the person will stay at home, if it is not raining then the person will go out. Depending on stay in or go out further decisions are made.

III. METHODOLOGY SUPPORTED BY DECISION SUPPORT SYSTEM

There are many algorithms which are implemented by various papers and journals.
[1] K-Means Clustering Algorithm:- The objective of this study is to develop a decision support tool based on K-Means clustering to determine the best niche for a store by analyzing the social network activity. In addition, this study shows how to mine data from Instagram, a social media platform that uses the Octopus API as a web data mining tool. The K-Means algorithm calculates the number of k centroids, assigning each data point to the nearest set.
As a result, we looked at 12754 articles that were posted on January 1st, 2019.The minimax and k-means algorithms are used to transform the cleaned-up data. For easier understanding, the result is a data file in json format that is centered on the map. The output of this research is visualization: a map indicating the location that best describes the placement of a certain store in the chosen area. The usefulness of its DSS tools is to give users access to photos that are more accurate and valuable decisions that minimize corporate losses and lower the likelihood of making bad business judgments.
[2]**Prediction Algorithm:-**Due to the collaboration of climatic controls with entirely various limits and entirely unique combinations, climate modification is currently one of the main problems. The proposed system combines tools that receive and process information obtained from the Country Ask around Center. The technique is based on the Time Course of Action Examination, a set of identifications of well-defined data items obtained through repeated estimations throughout time that makes use of computations capable of identifying the drift. As expected, the method is displayed in a table and charts with the suggested crops. Utilizing wish computation combined with the suggested crops, the system had successfully selected the flow of precipitation and scattering. It had the ability to change classification in an unintelligible shape and display the outcome of desire in graphical form.

[3]**Genetic Algorithm**:- In the study, a smart optimization method employing the Java genetic algorithm (GA) computer language is presented as being utilized to create a computational tool (Hydro-AI) to handle identified optimization challenges and make them easier for users to manage. Chromosome modelling was the first thing I did, followed by a functional analysis of the operators involved in the issue and, lastly, the design of a graphical user interface. The outcomes of the genetic algorithm and nonlinear programming, an optimization technique, were compared (NLP). Tests were carried out at hydroelectric plants 1, 3, and 7. GA operating costs are consistently lower than NLP operating costs as more interconnected hydropower units are added, according to comparisons of GA and NLP technology. The application made it easy to change the simulation's parameters and visualize results. The tool made it easier to modify simulation parameters and view output results while integrating reliable problem-solving abilities without overly simplifying calculations.

CONCLUSION

A decision support system is an application based on a computer used to diagnose and provide accurate prediction using different classification algorithms. The accuracy of any algorithm mentioned above can be given if it is implemented on any of the models. Decision support systems are used in many domains like Education, Agriculture, HealthCare's is human power, robot or combination of both .DSS can increase the speed and efficiency as it can collect and analyze the real time data. DSS has the ability to cause information overload as it considers all the aspects of the problem.

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