INTEGRATED MULTIMEDIA BASED INTELLIGENT GROUP DECISION SUPPORT SYSTEM FOR ELECTRICAL POWER NETWORK

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ABSTRACT

Electrical Power Network in recent time requires an intelligent, virtual environment based decision process for the coordination of all its individual elements and the interrelated tasks. Its ultimate goal is to achieve maximum productivity and efficiency through the efficient and effective application of generation, transmission, distribution, pricing and regulatory systems. However, the complexity of electrical power network and the presence of conflicting multiple goals and objectives postulated by various groups emphasized the need of an intelligent group decision support system approach in this field. In this paper, an Integrated Multimedia based Intelligent Group Decision Support System (IMIGDSS) is presented, and its main components are analyzed and discussed. In particular attention is focused on the Data Base, Model Base, Central Black Board (CBB) and Multicriteria Futuristic Decision Process (MFDP) module. The model base interacts with Electrical Power Network Load Forecasting and Planning (EPNLFP) Module; Resource Optimization, Modeling and Simulation (ROMAS) Module; Electrical Power Network Control and Evaluation Process (EPNCAEP) Module, and MFDP Module through CBB for strategic planning, management control, operational planning and transaction processing. The richness of multimedia channels adds a totally new dimension in a group decision making for Electrical Power Network. The proposed IMIGDSS is a user friendly, highly interactive group decision making system, based on efficient intelligent and multimedia communication support for group discussions, retrieval of content and multi criteria decision analysis.

INTRODUCTION

Electrical power network plays a unique role in the development and supporting most of the major activities for the overall growth of a country. In many developed and developing countries, today's socio–economic environment has expanded the role of the technical managers, who, operates and design the electrical power network. Organizations and sectors capable of recruiting technical managers with sound technical expertise, interpersonal skills and management education are more likely to be successful in managing their limited resources for planning and controlling activities. The Electrical Power Network (EPN) can be divided into five sub-systems:

- Power Generating Sub-System (PGSS)- Include elements normally associated with the generation of power, such as generators and steam turbines and other accessories.
- Transmission Sub-Systems (TSS)- Consists of all substation activities including transmission lines, control houses, switchyards and transformers at power stations.
- Distribution Facilities Sub-Station (DFSS) –Include feeder lines, safety devices and distribution transformers at service drops.
- Network Control and Protection Facilities Sub-System (NCPFSS)-Comprises of the energy control center, the Supervisory Control and Data Acquisition (SCADA) system and some elements that provide network protection at the center.
- Auxiliary Facilities Sub-Station (AFSS) – Include storage yards, maintenance facilities and radio communication facilities for network maintenance.

Since the last few decades, the global trends towards liberalization of electric power market open up to give customers the opportunity to purchase energy at more favorable prices. This has resulted in restructuring of EPN. The generation is separated from transmission to enable competition among power plants to arrive at the cheapest production price. The high voltage system becomes the network simply to transmit energy from the generating plant to the regional networks. The transmission system takes over the role of meeting contractual agreement among different parties for delivering power. In the new environment, greater investment in the EPN will be made only if direct and short-term benefits can be expected through the reduced cost of generation, transmission and distribution. Several literatures are available in the field of power generation, transmission and distribution issues. Arriaga, Rudnic and Stadlin (1995), Hissey (1994) and Vojdani, Imparato, Saini Wollenberg and Happ (1996) have discussed various aspects of transmission system and pricing of transmission transaction in open access. Torre, Feltes, Roman and Merrill (1999) and Tabros (1994) have suggested various management and pricing aspects of transmission system in deregulated environment. To determine the economically adapted transmission system in open access a Genetic Algorithm based dynamic transmission planning methodology is formulated by Rudnic, Palma, Cura and Silva (1996). Handschin, Heine, Koing, Nikoden, Seibt and Palma (1998) have developed an object-oriented software for transmission planning issues. Parikh and Chattopdhyaya (1995) have discussed a multi area approach for economic aspects of an Indian transmission system. Bell, Daniel and Dunn (1999) have discussed the various security aspects on the distribution network from the operator's points of view. Djordje, McGillis, Galiana, Cheng and Loud (1997) have developed an integrated knowledge-based model of the power-system planning process and a generic approach for power-system design. They used this model and approach to develop a system that can solve the most common planning and design problems in power systems. Although their tool will not replace experienced human experts but it has the potential to automatically generate a wide set of design alternatives for a given power-system problem, while justifying its reasoning process. Hart, Uy, Green, LaPlace and Norosel (2000) have suggested various options for distribution automation in the context of current deregulated environment. Khare and Christie (1997) have discussed problems of dispatching active and reactive power on a large inter-connected power system to maintain security. It models operator's heuristics in the decision-making process by means of fuzzy sets.

For various strategic, tactical and operational planning and control, Decision Support Systems have been widely used. In large organizations and sectors, a single person rarely makes important decisions, more commonly the decisions are taken by a group of senior executives. A Group Decision Support System (GDSS) is an interactive computer–based system, which facilitates solution of unstructured problems by a set of decision-makers working together as a group. Lim, Raman and Wei (1991) have studied the effects of Group Decision Support Systems (GDSS) on decision making in various contexts, involving important variables such as group task and group size. Tavana, Kennedy and Joglekar (1996) have presented a framework to help a group of decision makers define and articulate a hierarchy of hiring criteria and sub-criteria and rate each of the candidates on that hierarchy. Hatcher (1992) presented a design of a geographically distributed group decision system that was used by the US Army. They remarked that the ability to both see and hear a colleague either in real time or via a CD-ROM recording enhances familiarity as well as the quality of the decision process. Teng (1993) proposed a functional taxonomy on two dimensions, content support and process support. The validity of the taxonomy was then demonstrated by fitting a large number of implemented or proposed system in GDSS research onto one of the 16 types. Saini, Saxena and Kalra (2000) described the application of internet technology for efficient management of the operational organizations for creation of synergistic intelligent group decision making and support systems. The designed Group Decision Support System SIGDMSS is a user friendly, highly interactive Intelligent Group Management System, based on inexpensive and efficient Internet communication support, for group discussions, retrieval of content and expeditious decision analysis. The SIGDMSS is designed with synergistic integration of a collection of neoteric intelligent and pragmatic, conventional paradigms and techniques to develop a state-of-art decision-making and support contraption. Most of the present Group Decision Support Systems contain the capabilities of communication technologies, computer technologies, database technologies and decision technologies to support the identification, analysis, formulation, evaluation, and solution of semi–structured or unstructured problems. The communication function results in any–place capability. Due to LAN, WAN, Teleconferencing etc. distances are becoming irrelevant, allowing users to share the same electronic workspace, whether in a face–to–face interaction or physically distant from each other. The data–base technology adds any–time capability. It permits users to work in same–time mode as well as in different–time mode (asynchronous), and in addition establishes an organizational memory.

This paper adds another important dimension i.e. use of multimedia technologies in Group Decision Support System to generate virtual (work) environments. Multimedia is a new, exciting field, which represents the merging of three important industries: computing, communication and broadcasting. A multimedia environment consists of various kinds of media data such as image, graphic, audio and video. The complexity of multimedia applications creates a stress on all the components of computer system. A multimedia operating system should be able to support new data types and provide synchronization of multiple date streams via real time scheduling and fast interrupt processing. Multimedia has many applications in various fields such as distance learning, electronic news distribution, medical application, POI/POS system, remote assessment, clinical information and Messaging Systems. Hatcher (1995) explored the ideas about a multimedia tool kit and provided a focus for development of a theoretical framework to assist in guiding the applications in multimedia supported group/organizational decision systems.

In this paper, an Integrated Multimedia based Intelligent Group Decision Support System (IMIGDSS) for Electrical Power Network is presented and its main components are analyzed and discussed. EPN in recent time requires an intelligent, virtual environment based group decision process for the coordination of all its individual elements and the interrelated tasks. Its ultimate goal is to achieve maximum productivity and efficiency through the efficient and effective application of generation, transmission, distribution, pricing and regulatory systems.

GROUP DECISION MAKING PROCESS

The key factor in a group decision-making, which is absent in individual decision making is the need for interaction between the group members during the decision making process. This has led researchers to focus on information exchange issues during group meetings in the design of Group Decision Support Systems. A Group Decision Support System (GDSS) also known as an Electronic Meeting System (EMS) is a set of software, hardware, language components and procedures, that support a group of people engaged in a decision related meeting and its major function is to support the three common group activities - information retrieval, sharing and use. The degree to which a GDSS facilitates the communication or information exchange, has been used by DeSanctis and Gallupe (1987) to classify GDSSs. There is also a great need for intelligence sharing between Group Decision Members (GDM) due to several factors. Interaction is very much essential when a complex decision problem is divided into hierarchy of sub–decision problems, each of which is solved by an individual within the group. To make a meaningful attempt at solving or understanding the overall decision problem, a member might need the intelligence of another member to solve or interpret criteria of complex decision problem. Radermacher (1994) discussed the scope of decision support system starting from the three words, decision, support and system that make up the term. Based on a decision-theory point of view, the notion of decision and related cognitive concepts were discussed, particularly in connection with the idea of supporting human decision makers in making decisions.

MULTIMEDIA PLATFORM

Multimedia Platform is now becoming a critical element in Multi Criteria Decision Making and Group Decision Making. Advances in hardware and software are serving as catalysts for multimedia applications. Multimedia can easily be associated with computer–aided exchange or transformation of group information that involves simultaneous and coordinated use of different communication media such as video, audio, graphic and animation Furht (1994). A Multimedia Operating System (MOS) should be able to support new data types and provide synchronization of multiple data streams via real time scheduling and fast interrupt processing. In multimedia, if the end user sees that a multimedia application is allowed to control what and when the elements are delivered, it is called 'Interactive Multimedia'. In multimedia if end user is provided a structure of linked elements through which he can navigate, it is Hypermedia. Multimedia project is called "linear" if it starts at a beginning and runs through to an end and is called "non- linear" if users are given navigational control to watch through the content at will and results in Interactive multimedia. Multimedia elements are put together into a project using software tools called 'Authoring Tools'. In addition to, providing a method for users to interact with the project, most authoring tools also offer facilities for creating and editing text and images, and have extensions to derive Digitized Video Disc (DVD) players. Essential multimedia peripherals, multimedia software tools [For Painting and Drawing–Canvas, Designer Image studio, Super paint etc; For CAD and 3D – Macro Model, Auto CAD, 3D – Studio, Super 3D etc.; For Image Editing – Color it, Colour Studio, Photoshop etc; For Sound Editing-Alchemy, Audioshop, Audiotrax, Encore etc; For Video and Movie Making-Movie Pak, Animator Pro, Premiere, Supervideo etc.; For Accessories- Capture, Image Pals, Photo Disc etc.], Multimedia Authoring tools, Query by Image Control (QBIC) Project, Retrieval of Multimedia [ROM] Object, Continuous Media Storage etc. are essential for multimedia based group decision making. For effective and efficient group decision-making, Multimedia environment must use Virtual World Tour Guide (VWTG), Multimedia Group Communication (MGC), Multimedia Use–Friendly Directory (MUFD) features.

DESCRIPTION OF IMIGDSS

Electrical power is the engine of growth of any developing country. No major economic activity can be sustained without adequate and reliable supply of power. EPN plays a unique role in supporting most of the infrastructure systems and the general public because of their dependence on electric power. Thus it needs a very careful planning and control actions. The operation of such a complex system requires many decision attributes. The network control function of EPN is performed from centralized Energy Control Centers (ECCs). These facilities may monitor generating facilities, transmission facilities and the distribution facilities. To monitor and control the EPN, these facilities utilize SCADA Systems and other management systems.

A control center coordinates the operation of bulk power system component and is responsible for operating the power system within a geographic region called a control area. One or more utility make up a control area. A control center is connected to other control centers with transmission tie lines. Through proper communications (metering and telemetry), the control center is constantly informed of generating plant output, transmission lines and ties to neighboring systems, and system conditions. A control center uses this information to ensure reliability by following reliability criteria and to maintain its interchange schedule with other control centers.

The proposed IMIGDSS is based on a black board problem solving architecture, where intelligent Multicriteria Futuristic Decision Process (MFDP) module based on Multi Criteria Futuristic Decision Making Methodology (Singh & Saxena, 1999) and Multimedia Platform associate to different EPN application components to interact through a Central Black Board (CBB). The basic components of the proposed IMIGDSS architecture are presented in Fig. 1. It underlines the main modules relating to the Electrical Power Network Load Forecasting and Planning (EPNLFP); Resource Optimization Modeling and Simulation (ROMAS); Electrical Power Network Control and Evaluation Process (EPNCAEP). Each module is customized with Data Base Management

System (DBMS) and Technology Base (TB). The interaction between the Group Decision Makers (GDM) and the global database takes place through a MFDP module for strategic planning, management control, operational planning and transaction processing with the tasks of defining the decision context, the main objectives, the criterias, the sub-criterias and the scenarios. The Group Facilitator coordinates the group use of technology and there is a Dialog Management System for use for both the facilitator and the GDM.

The source code of IMBIGDSS is written in 'C'. The system has many special features, which are very essential in a well-designed software package:

- There is no limit to problem dimensions other than the computer's physical memory and it has context-sensitive on-line help.
- It can be very easily converted to any other programming language version (including graphics, text output). It has full-screen editors in all stages of problem development.
- It is device independent. It automatically selects the best (highest resolution) graphics mode to display charts and other relevant information and the package can run on all IBM compatible machines.

THE DBMS SYSTEM

The main task of this system is the simplification of the preparation and input of data in EPN analysis programs and also control and verification of the bulk of data required by the

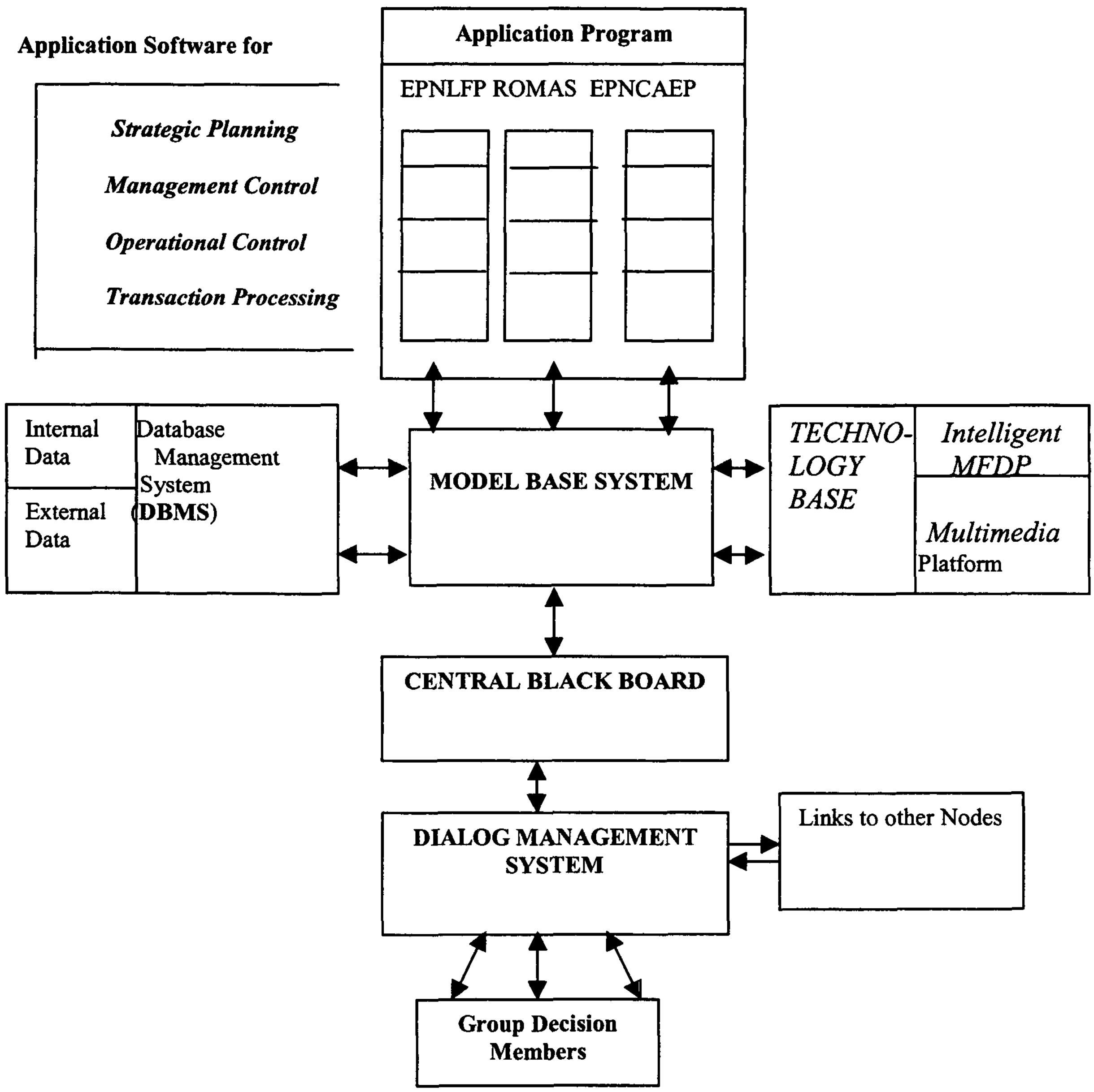

Fig. 1: IMIGDSS for Electrical Power Network

application programs. This database supplies data to various other modules. The main advantages of DBMS are:

- Privacy, since access to the system is strictly protected via a series of password locks.
- Protection against system corruption, through a backup and recovery mechanism.
- Economical storage combined with satisfactory speed of retrieval.
- Data independence from both hardware and application module through an appropriate architecture.
- Integrity of data, because they are logically and syntactically checked at the time they are entered via built-in validation procedures. The fact that every data item is stored in a unique memory portion guarantees data consistency.
- Very user-friendly operation through the use of interactive graphics and selection from menus of options.
- User-comprehensible organization of the data by the use of appropriately constructed tables and the implementation with relational model.

The DBMS is two-dimensional and the GDM are working with tables that have lines and columns like a spreadsheet. The GDM can easily travel through the data by the use of full-screen editor that permits them to scroll the data in all directions. The basic database of EPN consists of Generation, Transmission and Distribution data, affects on the environment, various cost and tariffs, maintenance scheduling and other charges.

Electrical Power Network Load Forecasting and Planning (EPNLFP) module

The importance of accurate forecasts in generation and transmission planning is that it ensures the availability of supply of electricity, as well as providing the means of avoiding over and under utilization of installed capacity and making the best possible use of capacity. Load forecast in transmission planning enables us to determine the amount of power to be transmitted to various regions from a generating station. Large errors in forecasting can lead to bad planning which can be costly. In generation forecasting too high forecast lead to operation of more plant capacity than is required and unnecessary capital expenditure whereas too low forecast prevent optimum economic growth and lead to the maintenance of many costly and expensive-to-run generators. These additional costs will finally be borne by the consumers. Transmission and distribution facilities, sales, profit, level of inventories, peak energy demands, nature and location of additional capacity of generation would depend on the forecasts. EPN forecast can be classified as:

Short Term Forecasts (STF)- The STF is necessary in planning the level and mix of generating capacity that will be used to support actual demand, and the sequence in which power stations are brought in operation. This will affect the fuel requirements and the associated overall costs.
Medium Term Forecast (MTF)- The MTF is used in preparing operating plans, financial planning and tariff setting. MTF is used to develop final details of the next plant in terms of the unit size and station size etc.
Long Term Forecasting (LTF)- The LTF of electricity consumption and demand is used in the planning of investment in generating capacity and the development of fuel supply. LTF is used for strategic decisions like optimum combination of plant types, determining the pattern of future expansions. Different important social indicators like population growth, employment requirements, technological development, population densities, economic growth rate in agricultural and industrial sectors etc. are taken into account.
Generation Planning for EPN is normally based on following crucial factors:
Project Location- The location of site for a project will have a vital bearing on efficient and economic operation of the system.
Project management and Layout- Layout and installation of a new generation unit will involve co-ordination of thousands of inter-related activities entrusted to various specialized agencies so as to meet the specified project schedule. Delays in execution of a project will not only result in cost overruns, but will also hamper the national development.
Mode of Generation and Unit Sizes- During generation planning one is confronted with possible alternatives either as regards mode of generation or unit sizes. In all such cases, the choice has to be finally made on economic considerations. Once the choice is made, detailed plan for financing the project has to be proposed using financial analysis techniques.
Types of Plants- Base load plants are nuclear, hydro and thermal with high load factor, high initial cost but lower operating cost. It is a better decision to consider installing more peaking units or plants with capacity to work in two-shift operation.
Timing- Timing depends upon construction period, reliability desired, selection of size and type, pattern of expansion, assistance available through interconnection and expansion timetable of interconnected system.

Transmission Planning for power system is based on the following factors:

Transmission management and layout- If a new line is to be constructed, it is very necessary to find out the route. Before selecting a route we must see the existing population living in that area and other geographical aspects. The layout and installation of a new transmission line or upgrading of existing facility will involve co-ordination of thousands of inter-related activities entrusted to various specialized agencies so as to meet the specified project schedule.
Modes of Transmission- Depending upon the amount of power to be transmitted, area to which power is to be transmitted and the cost involved in transmission we must select the mode of transmission. The mode of transmission may be Ac transmission or DC transmission, it may be overhead line or underground cable transmission system. The criteria for choice will have to be based on economic, safety and security considerations.
Timing- Timing depends upon construction or up-gradation period, reliability desired, selection of route and type of conductors required. The finances available and nature of expansion planning is also of great importance.

Distribution Network Planning and Design requires decision on the following factors-

Data Base Collection System- The database of the distribution network includes the customer class, behavior, financial conditions, metering information, geographical lay out of the area and the expected demand in a specific period.
System Layout- The manner in which the distribution system are split and re-split on their way from the substation to the consumer premises will affect the efficiency and economic operations of the distribution system.
Selection of Switching and Protection- Switching stations and substations are used to transform the electrical energy to a different voltage level. Adequate protection equipment must be installed at the substations and at the consumers' premises.
Communication systems- The communication system gives the electric utility an effective method for interrogating devices on the distribution system such as customer meters, switches, reclosures and fuses. The protocol selected for communication network for future integration, automation strategy and communication medium will have to be decided.
Timing- Timing depends upon construction period, reliability and safety desired, selection of right-of way, pattern of expansion in a particular consumer class.

Resource Optimization, Modeling and Simulation (ROMAS) module

In ROMAS, various possible alternatives for EPN layout are generated and designed in terms of optimal values in respect of economy, safety, reliability and quality of supply. Then, various alternatives have to be compared with respect to a set of criteria defined in the EPNCAEP module and the policy objectives established in the electrical power network MFDP module. Intelligent MFDP Module is used to allocate optimal resources and facilities. The ROMAS module is based on Group Decision Priority Ranking (GDPR) Model (Singh & Saxena, 2000) to give optimal group consensus ranking solutions and maximizes the overall futuristic decision priority. Then a sensitivity analysis, based on the most extreme sets of parameter value combination is performed. The results of the model are relatively sensitive to changes in estimates used for such parameter values. The basic aim of ROMAS module is the development and the application of tools for representing and measuring the impacts of the proposed objectives and criteria. From the point of view of optimization, modeling and simulation tools in a EPN Support System environment, there is full integration between different hierarchical levels and environment levels to provide users with an integrated framework.

Electrical Power Network Control and Evaluation Process (EPNCAEP) module

The basic functions of EPNCAEP module are commissioning, testing and checking the performance of the network against the expected or anticipated values, and in the event of performance being below the expected level taking corrective action to obtain improved performance. EPN control is mainly achieved through generation scheduling, budgetary control and inventory control. Scheduling of generation of different units is done to meet the set demand such that total generation is minimum and also deciding unit commitment during light load periods are important application of control. Production and consumption will have to be simultaneous which demands co-ordination of power generation, transmission and distribution functions to achieve optimum efficiency. A master plan is developed for power plants, which is further developed into monthly and daily generation schedules. In a capital scarce economy like ours it is essential to ensure that expenditure increased in a project is at all times, proportional to actual progress made. Private power handling utilities and state electricity boards have the responsibility to develop and maintain an economic system of power supply so that only the minimum necessary capital is invested. Budgetary control helps in realizing such economics and also furnishes information regarding actual position of capital commitments. Installation and maintenance of sophisticated inventory control system in a power plant is vital as stock out cost is prohibitive in power industry and reliability is the test of efficiency for power utilities. An EPN requires a huge store to handle a large volume of components and critical spares. The stock out cost being of very high order.

The evaluation process in EPN decision-making is a multistage and multilevel process based on the estimation and measurement of impacts according to time scales. Electricity generation, transmission and distribution are continuous process. Any laxity in these sets off adverse chain reactions culminating in the consumer dissatisfaction and suffering. Different power system evaluation categories must be set according to the decision-making problems and context such as operational analysis or socio-economic evaluation. The aim of an operational analysis is to verify if the EPN fulfills technical requirements and is reliable and effective with respect to detailed and specific technical objectives. In this case, alternatives correspond to different technical options and the evaluation criteria are technical indices. The corresponding impacts and effects are measured by impact analysis. The performance of EPN is judged by the following standards:

- Power supply facilities should be planned and executed in such a manner that, besides being uninterrupted supply, at no point of time shortage of power occurs.
- Maximum production could be achieved from the installed power supply facilities by taking all measures, so that there is no labor or personnel unrest leading to disruption in power supply.
- Ensuring adequate and stable supply of power throughout the service area as per the need of the users is then tacit obligation of the monopolistic nature of the power supply industry.
- To earn sufficient revenue not only to become self sufficient from revenue expenditure point of view but also to finance substantial part of new schemes.
- Consumer's voltages to be maintained as close to the declared values as possible.
- The aim of socio-economical evaluation is to determine the final utility for the people affected. In this case, criteria do not refer to technical indices but to social gains and losses.

Central Black Board (CBB)

A Central Black Board model for EPN is a conceptual architecture having independent and interactive knowledge based agents as data completion, data analysis and prediction and control functions. It stores a representation of the EPN structures and services. The designed IMIGDSS is based on a black board problem solving architecture where intelligent MFDP module and Multimedia platform connected to various EPN components interact through a CBB model. In this model database, local knowledge base and specialized technology base sources act upon a common globally shared database known as Central Black Board, according to a strategy aiming at building a group problem solution, both cooperatively and opportunistically. The CBB Model is well suited for real-time systems and is basically communication medium that enables information to be shared among the group users. This modular and distributed computing environment allows a kind of parallel processing and reasoning with the integration of intelligent MFDP module and Multimedia platform, specialized for each of the different module.

Multicriteria Futuristic Decision Process (MFDP) module

MFDP Module is a multi–person, multi–objective, multi–disciplinary, multi-level, multi-period, multi–dimensional futurologistic, group decision ranking module based, on feedback of Multi Disciplinary Functional Groups (MDFG) of Electrical Power Network Decision Making Group (EPNDM), Electrical Power Network Expert (EPNEP) Group and Inter-disciplinary Futuristic (IF) Group; to simulate decision problems. MFDP Module is a non–linear framework for carrying out both deductive and inductive intelligent thinking that allows the consideration of several factors at a time, along with a feedback mechanism and numerical trade–off, without the use of syllogism. The MFDP Module is primarily based on following main principles:

- The Electrical Power Network Current Decision Plan (EPNCDP) for the goal is developed by EPNEP Group with the aid of the possible pictures of the future, characterized as– a negative picture, a neutral picture and an optimistic picture.
- The EPNCDP generated by Outside – In Approach (OIA) and Inside – Out Approach (IOA) is clustered into Multi Futuristic Decision Factors (MFDF) by EPNEP Group.
- The MFDF are prioritized by a Structure Group Communication (SGC) technique to accomplish controlled feedback of IF Group, in and out contributions and flow of information and knowledge, assessment of the group judgment or view, opportunity for IF Group to revise views and degree of anonymity for the IF group.

- The prioritized MFDF of EPN are pulled together through the Principle of Hierarchic Composition to provide the Overall Futuristic Decision Priority (FDP) Weights of the available MFDF of the system.
- The stability of the outcome to changes in the importance of the MFDF is determined by testing the best choice against "What if" type of change in the priorities of the MFDF.

MFDP Module allows groups to lay out a problem as they see it in its complexity and to redefine its definition and structure through interaction. Through a mathematical sequence, Multi Disciplinary Functional Groups (MDFG) Members synthesizes their futuristic judgments into an overall estimate of the relative futuristic priorities of alternative courses of action. It tracks inconsistencies in the Multi Disciplinary Functional Groups (MDFG) Members futuristic judgments and preferences, there by enabling group decision makers to access the quality of their futuristic assessments knowledge and the stability of the solution.

CONCLUSIONS

An Interactive Multimedia based Intelligent Group Decision Support System (IMIGDSS) for electrical power network is presented in this paper. In particular emphasis is focused on database, model base, central black board and Multicriteria Futuristic Decision Process (MFDP) module. MFDP module provides a comprehensive framework for group decision making of multi-criteria problems of electrical power network by choosing the best one in a set of competing futuristic alternatives. The IMIGDSS facilitates the exchange of information, data, processes in text, audio, video, animation and graphics form between the distribution network group members without the need for a meeting or direct communication. This model also incorporates the feedback from the end group users. The system can test existing as well new plans and several "What-if" situations and evaluate the associated impacts. It will help in operating at strategic, tactical and operational level, through the best use of the existing facilities.

REFERENCES

Arriaga I.J.P., Hugh Rudnick and Walter O. Stadlin (1995), "International Power System Transmission Open Access Experience", **IEEE Trans. on Power Systems,** 10(1), 554-561.

Bell K.R.W., A.R.Daniel and R.W. Dunn (1999), "Modeling of operators heuristics in distribution for security enhancement", **IEEE Transactions on Power Systems,** Vol. 14, No. 3.

DeSanctis,G. and R.B.Gallupe (1987), "A Foundation for the Study of Group Decision Support Systems", **Management Science,** 33(5), 589-609.

Djordje, A., D.T. McGillis, Francisco D. Galiana, John Cheng, and Lester Loud (1997), "An Integrated Knowledge-Based Model for Power-System Planning", **IEEE Expert/Intelligent Systems & Their Applications,** Vol. 12, No. 4.

Furht, B. (1994), " Multimedia Systems: An Overview ", **Proceedings IEEE,** 1,47-59.

Hart, D.G., D.Uy, J.Northcote-Green, C.LaPlace, D. Norosel (2000), "Automated solutions for distribution feeders", **IEEE Computer applications in Power,** 25-30.

Handschin E., Michael Heine, Dieter Konig, Torsten Nikoden, Thomas Seibt and Rodrigo Palma (1998), "Object-Oriented Software Engineering for Transmission Planning in Open Access Schemes", **IEEE Trans. on Power Systems,** 13, 94-100.

Hatcher, M.E. (1992), "A Video Conferencing System for the United States Army: Group Decision- Making in a Geographically Distributed Environment", **Decision Support Systems,** 8, 181-190.

Hissey T. (1994), "International Experience in Transmission Open Access", **IEEE Power Engineering Review,** 14(12), 3-18.

Khare, R. and R.D.Christie (1997), "Prioritizing emergency control problems with fuzzy set theory", IEEE Transactions on Power Systems, *Vol. 12*, No. 3, 1237-44.

Lim, Lai-Huat, K.S.Raman and Kwok-Kee Wei (1991), "Interacting effects of GDSS and Leadership", **Decision Support Systems,** 12, 199-211.

Montfort, B. and P.Lederer (1986), "Generation Planning at Electricite de France- A Sharp Focus for the decade", **Electrical Power and Energy Systems,** 8(2).

Parikh J., D. Chattopadhyay (1995), "A Multi-Area Linear Approach for Analysis of Economic Operation of the Indian Power System", **IEEE Trans. on Power Systems,** 11(1), 52-58.

Rudnick H., Rodrigo Palma, Eliana Cura and Carlos Silva (1996), "Economically Adapted Transmission System in Open Access Schemes – Applications of Genetic Algorithms", **IEEE Trans. on Power Systems,** 11(3), 1427-1440.

Radermacher, F.J. (1994), "Decision Support Systems: Scope and Potential", **Decision Support Systems,** 12, 257-265.

Saini R., P.K.Saxena and P.K.Kalra (2000), " Internet Enabled Synergistic Intelligent Systems and their Applications to Efficient Management of Operational Organizations", **Information Sciences**, 127, 45-62.

Singh Preetvanti and P.K. Saxena (1999), "Futuristic decision priorities to eradicate tribal population by the year 2020 AD", **Advances in Bio Sciences**, 18(1), 15-22.

Singh Preetvanti and P.K. Saxena (2000), "Group Decision Priority Ranking Model for Transportation Planning", Working Paper, *MHRD/Engg.-PV*, Faculty of Engg., DEI, Dayalbagh, Agra, 1-12.

Tabors R.D. (1994), "Transmission System Management & Pricing: New Paradigms and International Comparisons", **IEEE Trans. on Power Systems**, 9, 206-215.

Tavana, M., D.T.Kennedy and P. Joglekar (1996), "A Group Decision Support Framework for Consensus Ranking of Technical Manger Candidates", **Omega**, 24(5), 523-538.

Teng, J.T.C. and K.Ramamurthy (1993), "Group Decision Support Systems: Clarifying the Concept and Establishing a Functional Taxonomy", **INFOR**, 31(3), 166-184.

Teofilo De la Torre, J.W.Feltes, T.G.S.Roman and H.M.Merrill (1999), "Deregulation, Privatization and Competition: Transmission Planning under Uncertainty", **IEEE Transactions on Power Systems**, 14(2), 460-465.

Vojdani A.F., C.F. Imparato, N.K. Saini, B.F. Wollenberg and H.H. Happ (1996), "Transmission Access Issues", **IEEE Transactions on Power Systems**, 11(1), 41-51.