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- Requirements Engineering
- Efficient Indexing and Retrieval
- Investigation of Natural Convection
- Rectangular Microstrip Antennas

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From the Chief Author's Desk

We see a drastic momentum everywhere in all fields now a day. Which in turns, say a lot to everyone to excel with all possible way. The need of the hour is to pick the right key at the right time with all extras. Citing the computer versions, any automobile models, infrastructures, etc. It is not the result of any preplanning but the implementations of planning.

With these, we are constantly seeking to establish more formal links with researchers, scientists, engineers, specialists, technical experts, etc., associations, or other entities, particularly those who are active in the field of research, articles, research paper, etc. by inviting them to become affiliated with the Global Journals.

This Global Journal is like a banyan tree whose branches are many and each branch acts like a strong root itself.

Intentions are very clear to do best in all possible way with all care.

Dr. R. K. Dixit
Chief Author
chiefauthor@globaljournals.org

The Use of Ontologies in Requirements Engineering

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Abstract **- With the advent of the Semantic Web and the technologies for its realization, the possibilities for applying ontologies as a means to define the information and knowledge semantics become more and more accepted in different domains. The nature of requirements engineering involves capturing knowledge from diverse sources, including many stakeholders with their own interests and points of view. There are, therefore, many potential uses of ontologies in Requirements Engineering (RE). The purpose of this paper is to comprehensively review and present these uses. The main contribution is the classification of approaches that include ontologies within RE, with the aim of clarifying the way in which traditional RE techniques can benefit from them. Furthermore, future trends are identified**.

Keywords- Requirements Engineering, Ontologies, Framework

I. Introduction

Ontology can be defined as a specification of a conceptualization [1]. More precisely, ontology is an explicit formal specification of how to represent the entities that exist in a given domain of interest and the relationships that hold among them [2]. In general, for an ontology to be useful, it must represent a shared, agreed upon conceptualization.Ontologies have been used in many contexts and for many purposes throughout the years due to, principally, the advent of the Semantic Web [3]. Recently, the use of ontologies in software engineering has gained popularity for two main reasons: (i) they facilitate the semantic interoperability and (ii) they facilitate machine reasoning. Researchers have so far proposed many different synergies between software engineering and ontologies [4]. For example, ontologies are proposed to be used in requirements engineering [5], software implementation [6], and software maintenance [7] [8].There is an increasing amount of research devoted to utilizing ontologies in software engineering, and Requirements Engineering in particular. Thus, the main objective of this paper is to further examine this trend. The remainder of the paper is structured as follows: Section 2 presents the main concepts related to Requirements Engineering and Ontological Engineering. Section 3 analyzes the benefits of applying ontologies in Requirements Engineering and presents a framework for integrating ontologies in Requirements Engineering. In Section 4, ontologies in RE are presented. Finally, in Section 5, the conclusions and future trends are discussed.

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II. Background

a) Requirements Engineering

The primary measure for an information system to be successful is the degree in which it meets the intended purpose. Requirements Engineering (RE) is the process of discovering that purpose by identifying stakeholders and their needs, and documenting them for their future analysis, communication, and subsequent implementation [9]. RE is understood as a subtask of Software Engineering, which proposes methods and tools to facilitate the definition of all desired goals and functionalities of the software.Figure 1 shows an iterative cycle of core activities executed in RE [9]. All tasks presented in this figure generate diverse deliverables, in order to document obtained results along the RE process. There are diverse requirements specifications. They are mainly created in the "Requirements Representation" stage in Figure 1. These specifications are generally complementary, and very difficult to define. Thus, software engineers are often faced with the necessity to redesign and iterate due to the lack of information and differences in interpretation [10].Diverse other challenges must be faced during RE activities in order to generate, at early stages of software development, consistent and complete requirements and to efficiently feed subsequent stages. One of those challenges is the management of participating organizations (through their stakeholders) in requirements gathering, considering the frequent lack of technical knowledge.

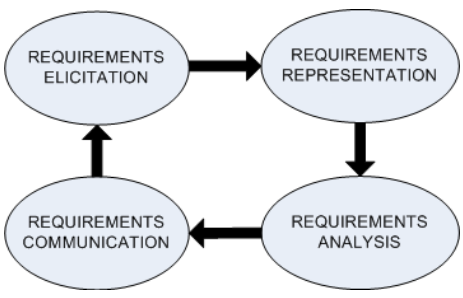


Fig.1. Requirements Engineering Activities.

Therefore, effective tools must be provided to achieve a complete analysis, considering particular and general needs and to manage requirements as a complete collaborative

process [11].Moreover, in RE processes there is a continual need for efficiently managing the great volume of information and knowledge generated and used during all activities presented in Figure 1. Thus, ambiguous requirements must be minimized since they produce waste of time and repeated work. They arise, for example, when different stakeholders produce different interpretations for the same requirement during the "Requirements Analysis" activity.

b) *Ontological Engineering*

The word ontology comes from the Greek ontos (being) and logos (word). It denotes the science of being and the descriptions for the organization, designation and categorization of existence [1]. Carried over to computer science in the field of artificial intelligence and information technologies, an ontology is understood as a representational artifact for specifying the semantics or meaning about the information or knowledge in a certain domain in a structured form [12]. Then, an ontology is used to reason about the properties of that domain, and might be used to describe the domain.Ontologies can be classified according to the task they are meant to fulfill [13]. Knowledge representation ontologies describe the modeling primitives applicable for knowledge formalization. Top-level ontologies, also called upper-level ontologies, try to comprehensively capture knowledge about the world in general, describing for example: space, time, object, event or action, and so forth, independently of a particular domain. Domain ontologies and task ontologies contain reusable vocabularies with their relations describing a specific domain or activity. They can specialize the terms of top-level ontologies.Several methodologies for developing ontologies have been described during the last decade [14] [15]. The objective of these methodologies is to define a strategy for identifying the key concepts that exist in a given domain, their properties and the relationships that hold between them; identifying natural language terms to refer to such concepts, relations and attributes; and structuring domain knowledge into explicit conceptual models. Two groups of methodologies can be figured out. The first one is the group of experience-based methodologies represented by the Grûninger and Fox methodology defined in the TOVE project [16] and by the Uschold and King methodology based on the experience of developing the Enterprise Ontology [17]. The second one is the group of methodologies that propose a set of activities to develop ontologies based on their life cycle and the prototype refinement, such as the METHONTOLOGY methodology [13], the Ontology Development 101 Method [18] and the methodology defined by Brusa et al. [19]. Usually, the first group of methodologies is appropriate when the purposes and requirements of the ontology are clear, while the second group is useful when the environment is dynamic and difficult to understand, and the objectives are not clear from the beginning [20].For ontology representation in a machine-interpretable way, different languages exist. Ontology languages are usually declarative languages commonly based on either first-order logic or on description logic. Ontology languages based on first-order logic have high expressive power, but computational properties such as decidability are not always achieved due to the complexity of reasoning [21]. The most popular language based on description logic is OWL DL, which have attractive and well-understood computational properties [22]. Another relevant language in Ontological Engineering is the Resource Description Framework (RDF). RDF was originally meant to represent metadata about web resources, but it can also be used to link information stored in any information source with semantics defined in an ontology. The basic construction in RDF is an (Object, Attribute, Value) triplet: an object O has an attribute A with value V. A RDF-triplet corresponds to the relation that could be written as *(O, A, V)*, such as for example *(Professor; teaches; ArtificialIntelligence)*.

III. Benefits of Applying Ontologies in RE

The study of an information system requirements should result in the establishment of well-defined functionalities and attributes agreed by the stakeholders. If the functionalities are defined as incomplete or incorrect, the software may not meet the expectations of users. Factors that could lead to an inadequate process of requirements elicitation can be:

- *Ambiguous Requirements*: which produce lost of time and repeated work. Their origin resides in the diverse stakeholders, who produce different interpretations of the same requirement. Moreover, one stakeholder can interpret the same requirement in diverse ways. The ambiguity conduces to mistaken product tests.
- *Insufficient Specifications*: they produce the absence of key requirements. This conduces to developers' frustration, because they base their work in incorrect suppositions and, so, the required product is not developed, which displeases the clients.
- *Requirements not completely defined*: they make impossible the project secure planning and its monitoring. The poor requirements understanding leads to optimistic estimations, which return against when the agreed limits are surpassed.
- *Dynamic and changing requirements*: which require constant requirements revision in order to help to understand new clients needs and to identify how they can be satisfied.

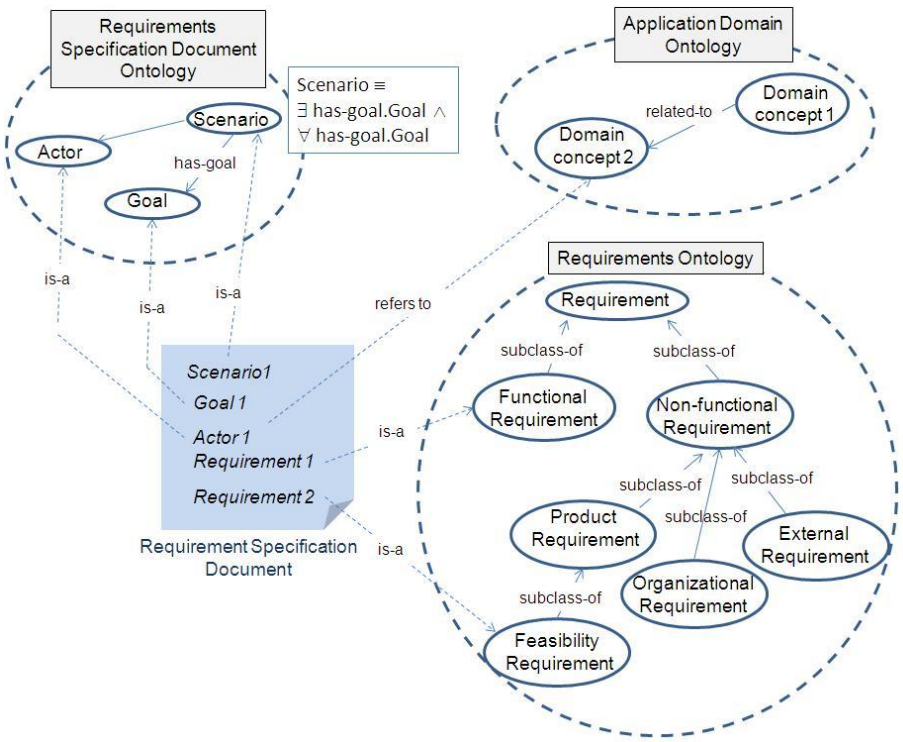
In order to reduce the negative effects of the previous factors on the RE processes, the ontologies can be used. The potential uses of ontologies in RE include the representation of: (i) The requirements model, imposing and enabling a particular paradigmatic way of structuring requirements, (ii) Acquisition structures for domain knowledge, and (iii) The knowledge of the application domain. Figure 2 shows a framework that depicts the interrelations between the ontologies previously described and a requirement

specification document. In this figure the following ontologies can be identified:

- *Requirements Ontology*. Requirement specifications are the descriptions of the desired software characteristics specified by the customers. This model can be defined using an upper-level ontology. For example, Figure 2 shows a portion of an ontology that describes the non-functional requirements defined by Sommerville [23]. This ontology can be used during the elicitation process to reduce ambiguous requirements and avoid incomplete requirements definitions. Restrictions about requirements can be defined in this ontology. They help in requirements validation and verification.
- *Requirements Specification Document Ontology*. In RE different approaches are used as intermediate steps for obtaining requirements. One of these approaches is the technique of scenarios [24], which are exemplary descriptions of the usage of the planned system to reach a defined goal. In Figure 2, a portion of an ontology that represents the semantics related to the scenario approach is presented. The use of ontologies for describing the structure of requirements specification documents reduce the insufficient requirements specifications. Furthermore, they can greatly help in the definition of several structures for showing the same knowledge, in order to, for example, involve all stakeholders in the analysis of elicited requirements. Moreover, they can also help in reusing structured representation for diverse objectives or projects, only changing their content.
- *Application Domain Ontology.* This ontology represents the application domain knowledge and business information required for building software applications in a specific domain. It also includes the semantic relationships established among their concepts from a real-world point of view. An application domain ontology is useful to identify dynamic and changing requirements since it helps to understand the domain.

The arrows between the requirements specification document and the ontologies in Figure 2 represent conceptual dependencies. These dependencies can be defined using the RDF language. For example:
(Scenario1, is-a, Scenario)
(Goal1, is-a, Goal)
(Actor1, refersto, DomainConcept2)
(Requirement1, is-a, FunctionalRequirement)
(Requirement2, is-a, FeasibilityRequirement)
Thus, defining the requirements by using the previous framework makes possible to trace dependencies among them, their sources and implementations. In Figure 2, portions of ontologies are presented as examples. In the following section research made towards ontologies in RE is presented. Diverse results can be used for implementing the proposed framework.

Fig. 2. Ontology-based framework for supporting semantics based Requirements Engineering



IV. Ontologies in RE

A. *Ontologies for Describing Requirements Specification Documents*

A well-characterized requirements specification is important to the design stage of software development and to the evaluation and reuse of elicited requirements. Specifications are formed of both, the document structure and its content. In this sense, Groza et al. [25] affirm that the structure of a document has a very important influence in the perception of its content. Reuse is one of the most required features for any software product. It is based on the form in which requirements are specified, documented and structured. Nevertheless, the reuse faces several challenges. These challenges are caused by insufficient support for its steps, such as search, evaluation and adaptation. One way of exchanging reusable requirements specification documents is through Wiki systems, which allow the self-organized reuse since the community provides and organizes the artifacts to be reused [26].The analysis of Wikis as solutions in this area is a very novel approach. The proposals conclude that requirements specification documents can specially benefit from ontologies, moreover when the content of those documents grows in a chaotic way. One way of solving this issue is structuring the knowledge by enriching the documents with additional metadata and finding interrelated useful content adding semantics to the documents extending the wiki with RDF, this way the semantic is expressed in a machine-understandable format. This solution is known as Semantic Wiki and can be considered as a lightweight platform.Another advantage of this approach is the automatic reasoning support and communication of used concepts.Furthermore, reuse cannot be possible if requirements documents do not have two main attributes carefully balanced, as described by Hull et al. [27]: readability and processability. They can be greatly enhanced by the use of ontologies in requirements documentation. One clear example is adapted by Decker et al. [26] from the Use Case approach. They add diverse documents and new structures to the traditional Use Cases documentation. These new documents are known as templates and allow to capture knowledge. Each one has metadata, besides the ontology of the documents. The authors also allow the extension of the ontology linking different Use Cases to facilitate the search of documents of the same type with other projects.Another approach that uses templates is proposed by Groza et al. [25]. They describe a solution for generating different representations of the same document, known as templates, based on the metadata created by using a particular authoring and annotation framework. Proposals like this can be of great help in order to represent RE specifications structures, thus promoting the reuse of RE specification content using diverse structures representations.As mentioned before, it is widely demonstrated that the use of ontologies helps stakeholders to clarify their information needs and comes up with semantic representations of documents. Dragoni et al. [28] for example, present an approach for the ontological representation and retrieval of documents and queries for Information Retrieval Systems using a vector space model which use concepts instead of terms, where the documents are represented in a conceptual
way, and the importance of each concept is calculated.
All these approaches can be, in some way, integrated in order to define an ontology for capturing the RE documents structures, and so, promoting the adaptation of the same content in diverse formats in order to be understandable by all stakeholders. Moreover, an ontology with this goal, can be reutilized in diverse projects in order to structure knowledge proper for each one.

B. *Ontologies for Formally Representing Requirements*

The use of ontologies for the representation of requirements knowledge has been under study since a long time ago. One of the initial approaches in this area was presented by Lin et al. [29]. They propose a generic solution that provides an unambiguous, precise, reusable and easy to extend terminology with dependencies and relationships among captured and stored requirements. The proposal can be applied to any kind of product to reach diverse requirements: communication, traceability, completeness, and consistency. It also supports the detection of redundant or conflicting requirements. The developed ontology is implemented using Prolog. The authors propose the use of first order logic to identify the axioms and capture the definition, constraints and relationships among the objects. They also allow integrity checking of the design knowledge. Besides being a very complete proposal, one of its disadvantages is that the involved terminology is only shared by the engineers of the project, and thus, the customer is not aware of it. This way, some requirements might stand ambiguous.The relationships among captured and stored requirements defines the traceability of the RE process. Traceability is the ability to describe and follow the life of software artifacts in Software Engineering [30]. More specifically in RE, those artifacts are the requirements. Thus, in order to trace requirements to their sources and to the intermediary and final artifacts generated from them all over the development process, it is mandatory to consider and represent information related to their source and the requirement's history.Traceability also facilitates the reuse of the requirements and the related information. In this sense, and promoting requirements reuse, Veres et al. [31] define diverse requirements models and give rules for the mapping and traceability among them. Also Decker et al. [26] promote reuse by establishing a common requirements structure to be considered along Software Engineering activities. This is related to which Brewster et al. [32] affirm, that to build systems that solve real-world tasks, not only conceptualizations must be specified, but also, clarity over the problem solving must be given.In this way, Riechert et al. [33] present a semantic structure for capturing

requirements relevant information, in order to support the RE process semantically and to promote the collaboration of all stakeholders in software development processes. They also apply and evaluate the proposal in an e-government case study.The KAOS (from Knowledge Acquisition in autOmated Specification) methodology is a goal-oriented requirements engineering approach with a rich set of formal analysis techniques [34]. KAOS is described as a multiparadigm framework that allows to combine different levels of expression and reasoning: semi-formal for modeling and structuring goals, qualitative for selection among the alternatives, and formal when needed for more accurate reasoning [35].All goal-oriented approaches are more applicable for complex systems. They are commonly based on the not easy task of identifying goals. Then, nonfunctional requirements (NFRs) are derived from them. Their analysis and management is much more difficult than the functional requirements ones.As a more specific approach for using ontologies for representing NFRs knowledge, Dobson and Sawyer [5] propose an ontology for representing dependability between requirements. It considers diverse NFRs, such as: availability, reliability, safety, integrity, maintainability, and confidentiality. Meanwhile, another proposal in this area is given by Kassab [36] who develops an ontology which provides the definition of the general concepts relevant to NFRs, without reference to any particular domain. He describes, through the proposed ontology, diverse glossaries and taxonomies for NFRs. The first ones are used for generalization to the common NFRs concepts.Considering the importance of knowledge reuse and its application in Requirements Engineering, Wouters et al. [14] point out that one of the biggest problems in reusing use cases was to find similar or related ones to reuse. Thus, and in order to accomplish the reuse, they propose a semiformal description which, used together with a "human" format, can make it possible the reuse of use cases. The defined ontology has three categories of information: labels,concepts and relations. With these concepts diverse rules and queries can be created which, under a logic inference machine and together with algorithms, make it possible to find similar use cases.

C. *Ontologies for Formally Representing Application Domain Knowledge*

Domain ontologies are specific, high-level models of knowledge underlying all things, concepts, and phenomena of a given domain of discourse. As with other models, ontologies do not represent the entire world of interest. Rather, ontologists select aspects of reality relevant to their task [37]. Then, the selection of the methodology to be used for developing an ontology depends on the application that ontologists have in mind and the extensions that they anticipate. In software development, an ontology can be used at development time or at run time [38]. Using an ontology during the development stage enables designers to practice a higher level of knowledge reuse than is usually the case in software engineering. At run time, an ontology may enable, for instance, the communication between software agents or be used to support information integration. In both cases, the creation of the ontology starts at the RE process.Any software development process implies multiple stakeholders which collaborate with a common goal. At development time, a domain ontology can be used as a way of facilitating the understanding between stakeholders. Pohl [39] affirms that RE must elicit and understand the requirements from the relevant stakeholders and develop the requirements together with them. Thus, in order to maximize environment comprehension, a common understanding of the involved concepts must be carried out. This means, the requirements analysts should be endeavored and must work towards understanding the language used in the universe of discourse, to then initiate its modeling. A model of the environment represents the reality and considerably improves its comprehension.Thus, a crucial part of RE is the establishment of a common terminology by diverse stakeholders. To this aim, the methodologies described in Section 2.2 can be used at the first stage of the software development process.The traditional methodologies for developing ontologies appear to be unusable in distributed and decentralized settings, and so the systems that depend on them will fail to cope with dynamic requirements of big or open user groups [40]. In this sense, Breitman and Sampaio do Prado Leite [41] propose a process for building an application ontology during the requirements process based on the Language Extended Lexicon (LEL). The lexicon will provide systematization for the elicitation, model and analysis of ontology terms. The underlying philosophy of the lexicon falls in the contextualism category, according to which particularities of a system's use context must be understood in detail before requirements can be derived. This approach is new to ontology building, which traditionally associates generalization and abstraction approaches to the organization of the information. Application ontologies are much more restricted than domain ontologies and have a much more modest objective. The authors see the ontology of a web application as a sub-product of the requirements engineering activity.

V. Conclusions and Future Trends

The paper describes the diverse challenges that must be faced during RE activities. As mentioned before, RE involves several activities to generate consistent and complete requirements representation and specification, but due to the fact that stakeholders belong to different backgrounds, in addition to the great volume of information that must be managed, the need of a framework that helps in the whole process is noticeable. It also synthesizes diverse specific proposals based on ontologies, which were developed in order to help in diverse RE aspects. Moreover, as shown in the article, these proposals can be clearly divided into three application areas, such us: the description of requirements specification documents, the formal representation of the application domain knowledge, and the

formal representation of requirements.Although the approaches show an advance towards the demonstration of the importance of implementing technologies in certain circumstances and RE activities, more effort is still needed in order to generate an integrated framework, capable of addressing these challenges in an integrated way, and of being applied all over the RE process and its activities. This is even more important if the persistence of requirements in all the software development process is considered.This framework and its predominant characteristics were simply described in this paper. Once developed and implemented, it will be useful in requirements consistent management, specification, and knowledge representation activities during the entire software development project.Thus, future work will be focused on generating support for the framework in order to enhance and integrate requirements structure ontology generation, requirements content ontology generation and requirements domain ontology generation. This will allow the collaboration of all stakeholders in the definition of requirements along all involved tasks, and moreover, to define a common structure and knowledge representation format, capable of being used in the entire software development process.

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Structural Aspects and Surface Properties Molybdenum /Composite Oxide Catalysts

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***Abstract*-Molybdenum / composite oxide catalysts play an important role in dehydrogenation – hydrogenation process. In the present investigation, alumina-magnesia and alumina-chromia composite materials were used as supports. The structural and phase changes of the prepared catalysts were confirmed using different techniques: Fourier transformer infrared spectroscopy, x-ray diffraction pattern, differential scanning calorimetery and surface properties. X-ray diffraction pattern exhibited the formation of $MgMoO_4$ phase on the surface of alumina-magnesia support with small crystallite size. Bulky crystallites of MoO_3 and $Cr_2(MoO_4)_3$ were formed on alumina-chromia support. The thermal decomposition data emphasized the formation of $Cr_2(MoO_4)_3$ (230-280^oC), MoO_3 (400-450^oC) and $MgMoO_4$ (350-500^oC) phases. Surface properties indicate that, the bulky crystallites formed on the surface of alumina-chromia support, caused blocking of its pores and lead to an observed decrease in surface area from 240.2 m^2/g for Mo/alumina-magnesia to 91.04 m^2/g for Mo/alumina-chromia catalysts.**

Keywords- Molybdenum, Support, Catalyst, Alumina, Magnesia, Chromia Composite mixed oxides.

I. INTRODUCTION

Even though MoO_3as ssuch is a ery well-known catalyst due to its instability at higher temperature, it is often used in supported form. Supported molybdenum catalysts have been used in petroleum, chemical and pollution control industries, in addition tomany industrial processes such as dehydrogenation hydrogenation and reforming [(1)]. Earlier alumina, TiO_2, ZrO_2, $SiO_2$and MgO were used as supports for molybdenum and studied their various physicochemical and catalytic properties [(2, 3)]. It is a well-known fact that, in several catalytic reactions, catalysts supported on high surface area multicomponent oxide materials exhibit a better performance than when component oxides were used separately.It has been reported that high specific surface area molybdenum oxicarbide could be prepared from oxidative treatment of high surface area Mo_2C or low surface area MoO_3[(4, 5)] and or by slurry impregnation of molybdenum salt on activated carbon [(6)]. Daturi et al., [(7)] showed that high surface area Mo/SnO_2 catalyst was very active catalyst for the oxidative dehydrogenation of alcohols; it showed higher activity than Mo/TiO_2, Mo/Al_2O_3 and Mo/SiO_2 catalysts.Armaroli et al., [(8)] explored an alternative way to prepare Mo/Al_2O_3 catalyst by impregnation of molybdenum onto boehmite and then transformed it to MoO_3/alumina, the catalyst showed high surface area.Mixed oxide supports showed also high surface area and peculiar behavior compared to the original pure oxides. These due to the combination of dissimilar components in the same molecular network structure. Cadus et al., [(9)] prepared molybdenum supported on alumina-magnesia mixed oxide and found that, $MgMoO_4$ system provided high selectivity to propene. It has been pointed out that, the presence of MoO_3 helps in increasing the catalytic activity of molybdenum catalysts.Kumar et al., [(10)] prepared a series of molybdenum loading from 2 to 14 wt% on Al_2O_3-MgOmixed oxide by incipient wetness impregnation. The results indicated that, the presence of MoO_3 species further enhanced the acidity of catalyst favorable for hydrocracking.Some authors demonstrated that magnesium molybdate exhibited higher selectivity toward olefin formation compared with magnesium vanadate system. Each of these described an improvement in the catalytic activity of $MgMoO_4$ system with slight excess of molybdenum species [(11, 12)].Several molybdenum containing hydrotalcite like compound were prepared by different ionic exchange procedure using as parent synthetic hydrotalcite. The catalysts showed higher activity towards hydrogenation reaction [(13, 14)].This work concerned on studying the nature of molybdenum species on previously prepared alumina, alumina-magnesia and alumina-chromia composite mixed oxides. Emphasis was placed on the physicochemical characterization of the prepared catalysts with the aim of studying the nature of active sites and surface properties.

II. EXPERIMENTAL

A. Preparation of Composite Support

γ- Alumina, γ-alumina-magnesia and α-alumina-chromia composite mixed oxide support was previously prepared [(14)] via co-precipitation technique and followed by calcination at 450^{o}C for alumina and alumina-magnesia & at 600^{o}C for alumina-chromia composite materials.

B. Preparation of Catalyst

The catalysts were prepared by incipient wet impregnation technique, in which the prepared composite supports were impregnated with ammonium heptamolybdate solution at pH ~ 12 using ammonium hydroxide to prepare the corresponding catalysts. The prepared catalysts dried at 120^{o}C and then calcined in presence of flow of purified air. The calcination was performed in two steps, firstly from ambient temperature to 450^{o}C, maintained at this temperature for two hours, and then calcined at 600^{o}C for

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six hours. The amount of ammonium heptamolybdate was equivalent to 20wt% MoO_3 loading.

C. *Structural Phase changes*

The prepared catalysts were characterized by applying different techniques such as; Fourier transformer infrared spectroscopy, run on Perkin Elmer FT-IR apparatus, to identify the hydroxyl and the functional groups containing the catalysts. X-ray diffraction pattern,was carried out using XD-D1 – x-ray diffraction Schimadzu apparatus, to study the crystalline phases and the crystallite size usingSherrer's equation. Differential Scanning Calorimetryanalysis was carried out using the Differential Thermal Analyzer, Perken Elmer apparatus,to identify the different oxide phases formed upon thermal treatment. In addition, nitrogenphysisorption isotherms, was measured to calculatesurface area from adsorption curve by BET method.

D. *Surface Acidity*

A Boehm's base neutralization technique[15] was used for measuring the surface acidity of the prepared catalysts. In this technique, 0.2 gm of samplewas mixed with 100 ml of 0.1N NaOH solution and maintained overnight at room temperature. The mixture left to settle then filtered. The excess base (NaOH) was back titrated with standard solution of 0.1N HCl. Boehm concluded that NaOH neutralize the acidic groups and thereforemeasure the totalsurface acidity of the prepared catalysts.

III. RESULTS and DISCUSSION

a) *FT-IR Spectroscopy*

FT-IR spectrafor γ-alumina, molybdenum/alumina and thermal treated molybdenum/alumina, molybdenum/alumina-magnesia & molybdenum/ alumina-chromia catalysts were recorded at range from 2000-400 cm^{-1} and extended FT-IR spectra at 3800-3200 cm^{-1}. DatainFigure (1-a) reflected the appearance of band at1050cm^{-1} , that was typically for γ-alumina due to Al-O vibration mode. In addition , five bands in the OH stretching region 3800-3400 $cm^{1}$are appeared: a weak shoulder band at 3790 cm^{-1}related to the terminal OH over one tetrahedrally coordinated aluminum ion in non-vacant environment , band at3775cm^{-1} ascribed to the terminalOH over one tetrahedrally coordinatedaluminum ion near a cation vacancy,band at 3735 cm^{-1} related to terminal OH over one octahedrally coordinated Al ion, band at 3670cm^{-1} related to the bridging OH and band at 3590 cm^{-1}related to the triply bridging OH. Meanwhile, band appeared at 3570cm^{-1} assigned to stretching modes of physisorbed water (hydrogen- bonded hydroxyl water) [16, 17].Figure (1-b)ascribed one broad band, at 950 cm^{-1}, that can be observed for molybdenum/alumina catalyst. This band attributed to Mo-O stretching. Ono et al, [18] studied the system Mo-Zr and suggesting that band appeared at 960 cm^{-1} is related to superficial Mo species supported on ZrO_2 and suggesting that it resulted from the shifting of Mo-O bond stretching. Kaztelan et al., [1] used raman spectra to characterize Mo/Al_2O_3 catalyst with intermediate molybdenum loading and attributed the appearance of band in the range 941-947 cm^{-1} to heptamolybdate species $Mo_7O_{24}^{-2}$. Desikan et al,[19] employing also raman spectra and observed that the vibration band around 960-950cm^{-1} in Mo/Al_2O_3 and Mo/TiO_2 to dispersed isopolymolybdate and hydrated teterahedral dioxo species. Accordingly, the same type of bond and similar coordination characterize these Mo species on that their vibrational spectra should be similar in accordance in these observations, the band at 955 cm^{-1} is attributed to polymolybdate species dispersed on the surface. Band appeared at 3210 cm^{-1} was typical for N-H bond vibration of ammonium salt used during the preparation. Acidic hydroxyl group for γ- alumina (at 3670 cm^{-1}) is still appeared; meanwhile the most basic and basic hydroxyl groupat 3775 & 3735 $cm^{-1}$are disappeared. This ensures the complete interaction of molybdenum species with basic alumina hydroxyl groups.

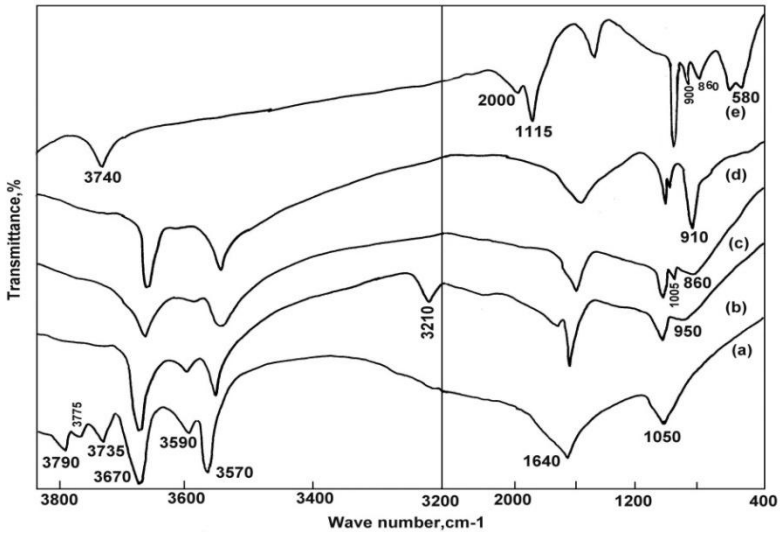


Fig. (1): FT-IR Spectra of: (a)γ-Alumina (b) Molybdenum/alumina (c) Molybdenum/alumina* (d) Molybdenum/alumina-magnesia* (e) Molybdenum/alumina-chromi

b) calcined catalysts

Segawa et al, [20] reported, molybdenum reacts with basic and neutral OH group of support and suggest the creation of Mo isolated species have tetrahedral coordination. Okmoto and Imanaka [21] observed that, molybdate anion reacts with most and moderate basic hydroxyl group at 3775 & 3735 cm^{-1} and these basic hydroxyl groups are the preferred interaction sites for the molybdate anion. In addition, the disappearance of these bands indicated that both OH groups are involved in the interaction with the same molybdate species i.e. bidentate chain like structure is formed. After calcination of molybdenum/alumina catalyst (Fig.1-c), band at 950 cm^{-1} is disappeared and another new feature appeared at 860 and 1005 cm^{-1}. These modifications have been previously observed for Mo supported on different oxide [22,23] and it has been explained by structural alterations in Mo species. According to Deskain et al, [19] this phenomenon would indicate on the presence of isolated tetrahedral Mo species that are present in octahedral coordination in the presence of water. Giodeno et.al, [22] have proposed that, at low Mo concentration (< 2% MoO_3), teterahedrally coordinated MoO_4^{2-} are present and that at moderate loading (4-20%MoO_3), both teterhedrally and octahedrally coordinated MoOx species are present. Chen et al, [23] reported the same conclusion. The vibration at 860 cm^{-1} may be associated with Mo-O-Mo or due to Mo-O-Al bonds, as investigated by Okamoto et al, [21]. Actually, band at 1005 cm^{-1} attributed to crystalline MoO_3 [20]. This band associated the vibration of Mo=O in MoO_3 and Mo-O-Al in aluminum molybdate phases.Whereby, the disappearance of bands at 3210 and 950 cm^{-1} accompanied the decomposition of ammonium heptamolybdate on thermal treatment. For calcined molybdenum/alumina-magnesia catalyst, band appeared at 910 cm^{-1} ascribed to magnesium molybdate, in addition to band assigned to MoO_3 species (at 1005 cm^{-1}, Fig.1-d). The spectrum for calcined molybdenum/alumina-chromia catalyst, in Fig. (1-e) presented the appearance of, band at 900 cm^{-1} that assigned to vibration of Mo-O-Cr in molybdenum dichromate, band at 2000 cm^{-1} assigned to chromate vibration and band at 850 cm^{-1}assigned to Cr-O-Cr vibration [24]. Band appeared at 580cm^{-1} typical of Cr^{+3} polymeric species,also this band assigned to Cr-O vibration with octahedrally distorted coordination of Cr atoms in Cr_2O_3 crystallites[25,26], in addition to MoO_3 band. Band appeared at 1115 cm^{-1}has been interpreted as due to bulk tetrahedrally Al-O stretching of α-alumina.In addition, band appeared at 3740 cm^{-1}related to bridged OH group and terminal octahedral OH group with vacancy and this is typical for α-alumina. The presence of chromia species facilitated transformation of γ- form to α- one at lower temperature "600°C" via sintering effect. Benitez et al, [27] reported that, the concentration of tetrahedrally coordinated molybdenum species strongly interacted withγ-alumina is decreased upon changing γ-alumina to α- form; meanwhile, the concentration of low interacted octahedrally coordinated molybdenum oxide species is increased.

c) X-ray Diffraction Pattern

X-ray diffraction pattern (XRD) for all the prepared and calcined catalystsare depicted in the Figs. (2-4). For molybdenum/alumina catalyst, the diffractogram in Fig.2-a, revealed the appearance of broad peaks characterized γ-alumina at d spacing: 2.41, 1.98 and 1.40Å, (ASTM 04-0875). Molybdenum species in ammonium heptamolybdate detected at d- spacing

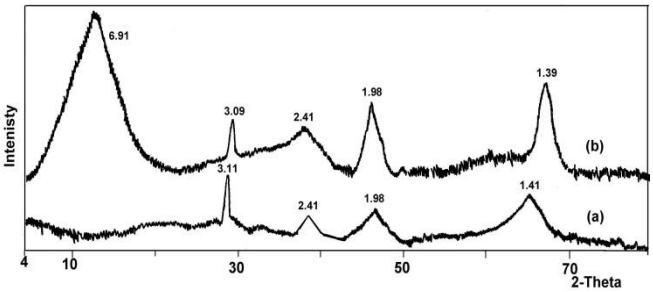


Fig.(2): X-ray Diffraction Pattern of: (a) Molybdenum/alumina (b) Molybdenum/alumina*

3.85, 3.11 and 1.85 Å [28,29]. Figure (2-a) revealed the appearance of line at d-spacing: 3.11 Å with low intensity, the other two lines may be shielded upon incorporation of molybdenum species inside alumina pores. Diffractogram for calcined molybdenum/alumina-magnesia (Fig. 2-b) , exhibited broad peaks at d-spacing 6.91, 3.09 and 2.41 Å that related to formation of $Al_2(MoO_4)_3$ phase [29].Zingg et al, [30] reported that, thediffusion of Mo cation into the support during the calcination step leading to a well-defined Al-molybdate.Wachs et al, [31] concluded that, Mo chemically adsorbed on the surface of alumina through the formation of Mo-O-Al bond yielding to superficial molybdate species.The broadening of aluminum molybdate peaks with slight high intensities related to that aluminum molybdate had relative large crystallite size to be detected by XRD and may be distorted [29, 30]. No lines were detected for presence of MoO_3 phase that may be formed with small amount and highly dispersed within the support surface.

For molybdenum/alumina-magnesia catalyst (Fig.3a), lines are detected at d-spacing 2.43, 2.02 and 1.42 Åcharacterized alumina-magnesia composite [30], in addition to that related to molybdenum species. After thermal treatment, x-ray diffraction pattern in Fig.3-b, revealed the appearance of lines atd-spacing 3.39, 2.08 and 1.43Å where $MgMoO_4$ phase was characterized by presence of these principal lines [31]. Thus, molybdenum reacted preferably with magnesia component of the support and formed very stable crystallites of $MgMoO_4$

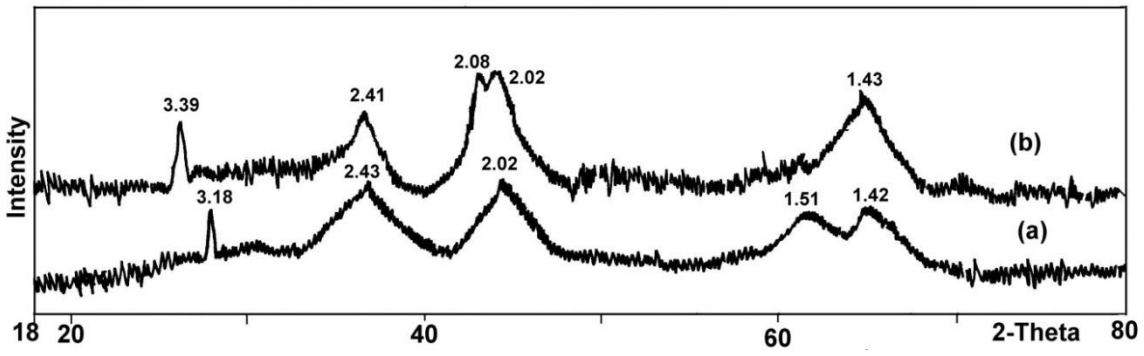


Fig.(3): X-ray Diffraction Pattern of: (a) Molybenum/alumina-magnesia (b) Molybdenum/alumina – magnesia

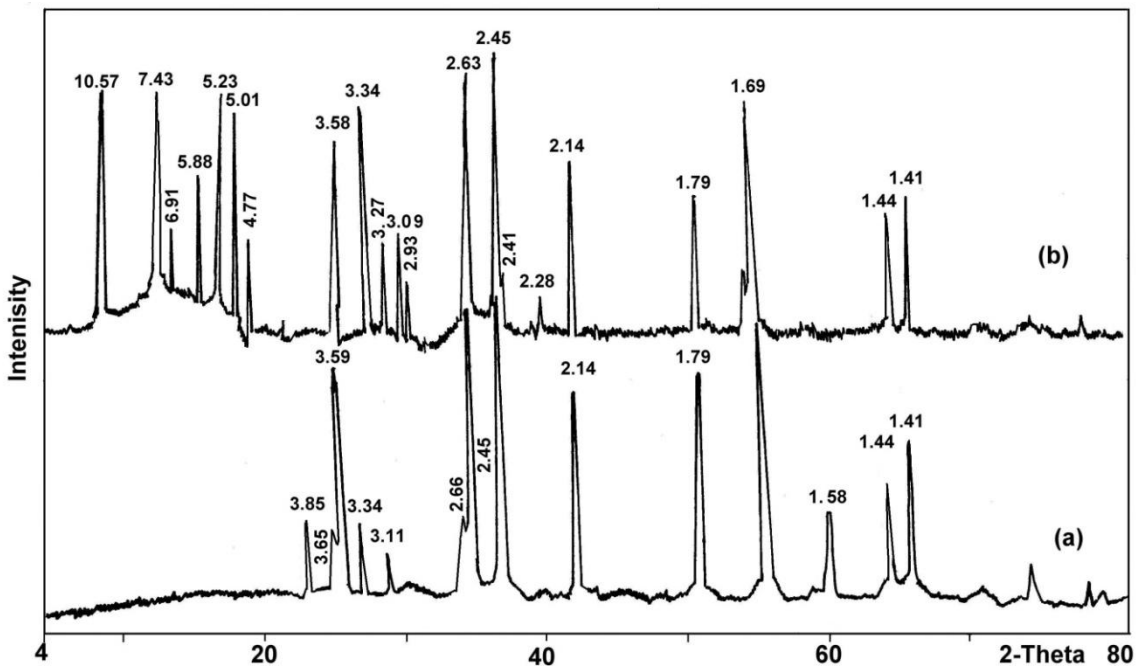


Fig.(4): X-ray Diffraction Pattern of: (a) molybdenum/alumina-chromia (b) molybdenum/alumina – chromia

The broadening of the peaks may be suggested that magnesium molybdate was distorted. In addition, no lines were detected for presence ofMoO_3 phase. Jolly et al, [32] indicated that, a considerable amount of MgO was hydrolyzed to $Mg(OH)_2$ upon impregnation with ammonium heptamolybdate salt solution , and this reacted with $Mo_7O_{24}^{-6}$ to $MgMoO_4$. When this catalyst heated at 600°C in presence of air, MgMoO4was identified in XRD as reported by Stampfi et al [33].For molybdenum/ alumina-chromia catalyst (Fig.4-a), lines detected at d-spacing : 3.65, 2.66 and 1.69 Å corresponded to Cr_2O_3 phase [34] and that detected at d-spacing : 3.59, 2.63 and 1.79 Å were corresponding to the presence of α-alumina [35], in addition to lines detected for presence of molybdenum species (d-pacing: 3.85, 3.11 and 1.58 Å) . Diffractogram for calcined molybdenum/alumina-chromia catalyst (Fig. 4-b), revealed the appearance of new lines at d-spacing: 7.43, 5.88 and 2.93 Å corresponded to$Cr_2(MoO_4)_3$ phase.Lines detected at d-spacing 5.01,5.23 and 4.77Å assigned to molybdenum dichromate phase [36, 37]. In addition, lines detected at 10.57, 3.27 and 2.28 Å related to MoO_3 phase and that at d-spacing: 6.91, 3.09 2.41 Å related to Al_2 $(MoO_4)_3$ phase formation [29, 30].

d) Crystallite size

Crystallite size data for the prepared catalysts before and after calcination were included in Table (1). Data indicated that, the crystallite size had relatively low values (7.0, 10.6 nm) for molybdenum/alumina–magnesia catalyst. This may be due to the presence of relatively smaller particles of basic magnesia comparing with competitive alumina particles that

allowed the dispersion of molybdenum species and consequently prevented their aggregation.

On the other hand, the crystallite for molybdenum/alumina-chromia catalyst, showed high values (47.0 and 44.9 nm). The higher value for such catalyst was owing to the presence of large acidic Cr_2O_3 ($2Cr^{+3}$ $3O^{-2}$) species which induced attraction forces between the different particles and permitted the aggregation of molybdenum species. In addition, the blooming of α-alumina increases crystallite size quickly, that means the formation of α-alumina accompanied by exaggerated grain growth.

Table (1): Crystallite Size forPrepared Molybdenum Catalysts.

2θ	Mo/alumina	Mo/alumina-magnesia	Mo/alumina-chromia
28.9	36.89	----	-----
36.79	23.36	7.00	47.00
41.9	----	-----	44..90
44.79	----	10.60	-----
2θ	**Mo/alumina***	**Mo/alumina-magnesia***	**Mo/alumina-chromia***
36.6	28.26	6.1	38.5
41.97	----	----	86.5
45.6	19.2	4.9	----

After thermal treatment, the crystallite size data showed the same trend as that obtained for the previous prepared catalysts. This ensures that alumina-magnesia supportprevented the formation of large molybdenum oxide particles and facilitated the dispersion of the formed magnesium molybdate phase on its surface, as clarified from XRD data. Concurrently, for calcined molybdenum/alumina-chromia, different chromium-molybdenum phases were formed on the surface ofalumina-chromia support; these species were migrated and agglomerated together to form bulky crystallites with size of, 38.5 and 86.5 nm or these phases may form a strongly packed layer cracks as a result of crystallite growth.

e) Base Neutralization

Applying Boehm'sbaseneutralization technique[15] for measuring the surface acidity of the prepared molybdenum catalysts, data is included in Table (2). Data clarified that the alumina-magnesia support exhibited the lowest surface acidity as compared with the other two supports.

Table (2): Surface Acidity for Prepared Molybdenum Catalysts.

Sample	Al_2O_3	Al_2O_3-MgO	Al_2O_3-Cr_2O_3	Mo/Al_2O_3*	Mo/Al_2O_3.MgO*	Mo/Al_2O_3-Cr_2O_3*
Acidity (meqv1 100.gm^{-1})	22.3	8.5	26.0	27.0	14.7	33.5

For the corresponding catalysts, the same trend was observed. In other words, calcined molybdenum/alumina-magnesia catalyst was the lowest onei.e. the presence of basic MgO limited the acidity of molybdenum/alumina-magnesia catalyst. The catalyst that had high surface acidity was molybdenum/alumina-chromia.

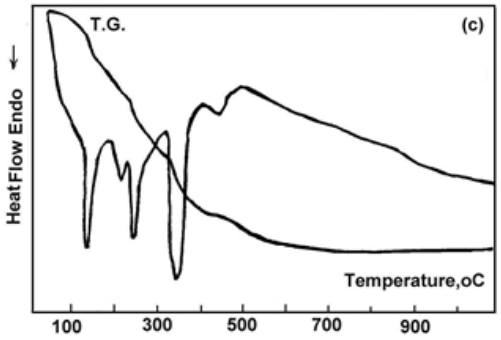
f) Differential Scanning Calorimetery

Differential scanningcalorimetery (DSC) profiles for the prepared catalysts represented in Fig (5).For molybdenum/alumina catalyst (Fig.5-a), three endothermic peaks appeared, the first at temperature range 100-180°C related to the removal of surface adsorbed water. The second peak appeared at temperature range 400-450°C related to the decomposition of $(NH4)_6Mo_7O_{24} \rightarrow 7MoO_3 + 6NH_3 + 3\ H_2O$, producing the corresponding oxide form [38]. The last one at 550-600°C corresponded to the formation of aluminum molybdate phase. Aluminum molybdate is a thermodynamically stable phase and has been reported to form in high loading at temperature ~ 600°C. Cheng and Scharader [39] have shown that aluminum molybdate is not formed when molybdenum/alumina catalyst is calcined at 550°C even though the MoO_3 content is 20 wt%.

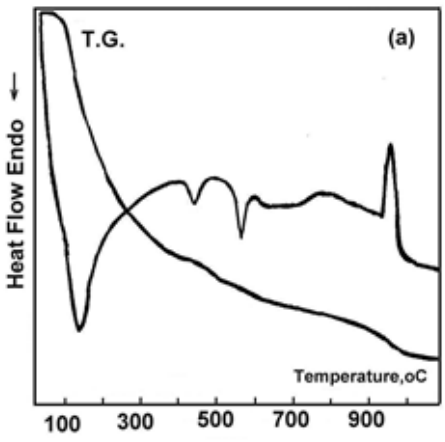
The heat of absorption (enthalpy) for thispeak is shown to be low value 3.87 μV.s/mg (Table 3), that indicated the easiest formation of polymolybdate species on the surface of amphoteric alumina support with its abundant OH groups, in agreement with the result ofThomazeau,etal[40] .

8 Als-OH + $Mo_7O_{24}^{6-}$ → 4 $(Als)_2MoO_4$ + 3 MoO_4^{-2} [1]

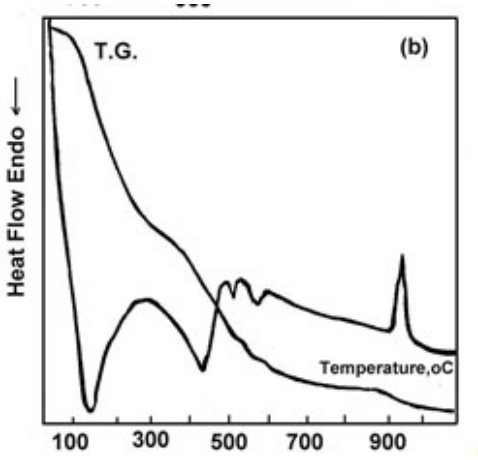
An exothermic peak appeared attemperature range 950-1000°C, related to transformation of γ-alumina to α-form [1].



Molybdenum/alumina



Molybdenum/alumina-magnesia



Molybdenum /alumina-chromia

For molybdenum/alumina-magnesia catalyst, DSC profile (Fig.5-b) revealed a new endothermic peak in addition to the surface adsorbed water, MoO_3 and aluminum molybdate phase peaks. This peak appeared at temperature range 350-500^oC that related to formation of magnesium molybdate [(29)], which co-existedwith aluminum molybdate on the catalyst surface. As well known, alumina-magnesia support contained abundant of basic hydroxyl groups,that allowed depolymerization of polymolybdate anion yielding monomeric species anchored to the oxide surface.

The formation of ammonium mono-molybdate can be represented as follow:

$$(NH4)_6Mo_7O_{24} + 8\ OH^- \rightarrow 3\ (NH_4)_2MoO_4 + 4\ MoO_4^{-2} + 4\ H_2O \quad [2]$$

under further heating, decomposition of ammonium mono-molybdate occurred with formation of ammonia:

$$MgO + (NH_4)_2MoO_4 \rightarrow 2\ NH_3 + MgMoO_4 + H_2O \quad [3]$$

As shown, strong base (MgO) replaced a weak one (ammonium species) in a molybdate salt and then basic OH group stabilized the highest Mo^{6+} oxidation state ($MgMoO_4$).MgO is a strong basic support, high local pH of this support led to depolymerization of polyoxomolybdates[(41)].Therefore, most tetrahedral MoO_4 moieties believed to be present in this catalyst. The low values of enthalpy: "4.67" for formation of magnesium molybdate species and "6.72 µV.s/mg" for aluminum molybdate ones (Table 3), indicate the easiest formation of these species. Radivan et.al, [(42)] reported that MoO_3 formed on support reacted preferentially with magnesia to form magnesium molybdate at 500^oC, and attributed the absence of all diffraction pattern of support as an indication for its complete transformation into $MgMoO_4$.The detection of MoO_3 by IR and DSC analyses in this work is related to the unreacted MoO_3 located far away from the composite surface that could highly inter dispersed among the $MgMoO_4$ particles or over its surface.For molybdenum/ alumina-chromia catalyst, four endothermic peaks appeared in addition to the surface water adsorption peak. The first at temperature range 200-230^{o}Cassigned to formation of molybdenum dichromate. The second and third endothermic peaks appeared at 230-280 and 280-380^{o}C related to formation of chromium molybdate and molybdenum oxide respectively. The fourth one, at 420-500 ^{o}C related to formation of aluminum molybdate phase. As well known, acidic support facilitated the formation of MoO_3bulk like particles beside the MoO_3 clusters and polymolybdate species[(41,42)].Enthalpy values were parallel to this behavior and showed a low values for the formation of these different oxide phases.As clarified, thetemperature of ammonium heptamolybdate decomposition on alumina-chromia support was lower than that on alumina – magnesia one.This may be owing to the presence of acidic chromia species that hasten the decomposition of ammonium heptamolybdate at lower temperature.The endothermal effects as showed in the thermogravimetric curve (TG, Fig. 5& Table3) accompanied the mass loss. This loss in weight resulted from the evolution of ammonia and H-bonded water, which may be attached either to already adsorb water molecule or to surface

Table (3): Thermal Analysis of Molybdenum Catalysts

Molybdenum/alumina			
Temperature^{o}C	Type of peak	Enthalpy µV.s/mg	Weight loss%
100-200	Endo-thermic	28.93	12.92
400-450	Endo-thermic	3.68	3.24
550-600	Endo-thermic	3.87	9.15
950-1000	Exo-thermic	-0.71	2.69
Molybdenum/alumina-magnesia			
Temperature^{o}C	Type of peak	Enthalpy µV.s/mg	Weight loss%
100-200	Endo-thermic	13.62	10.25
350-500	Endo-thermic	4.67	10.39
500-550	Endo-thermic	6.72	1.18
550-600	Endo-thermic	16.72	2.01
950-1000	Exo-thermic	-0.42	1.77
Molybdenum/alumina-chromia			
Temperature^{o}C	Type of peak	Enthalpy µV.s/mg	Weight loss%
100-180	Endo-thermic	13.33	12.92
200-230	Endo-thermic	0.67	5.56
230-280	Endo-thermic	6.72	13.71
280-380	Endo-thermic	26.06	17.62
420-500	Endo-thermic	0.84	6.81

hydroxyl groups.The weight losses accompanied the formation of MoO_3 phase on either alumina or alumina-magnesia supports were low values, 3.24 and 1.18%, respectively. This is the reason for the impossibility of detection of MoO_3 phase by XRD on these supports. Consequently, the support is not fully covered for molybdate layer and there is small amount of MoO_3 on the support surface. Meanwhile, the weight loss accompanied the formation of MoO_3 on alumina-chromia support is high value 17.62%, that is in agreement with Thomazeau, et. al, [40] who observed the decomposition of ammonium heptamplybdate on acidic silica and niobia(Nb_2O_5), facilitated the formation of bulky MoO_3 and plymolybdate species, silicomolybdic acid could also be identified.

g) Surface Area and Pore Structure

Nitrogen isotherms were measured using Quantachrome NoavaAutomated Gas Sorption apparatus. Full nitrogen adsorption-desorption isotherms were obtained for molybdenum/alumina catalyst and that produced after thermal treatment of, molybdenum/alumina, molybdenum/alumina-magnesia and molybdenum/ alumina-chromiaones. Specific surface area (S_{BET}), total pore volume (V_p) and mean pore radius (r_H)**,** BET-C constant and fraction of micro porosity (m_f %) data were included in Table (4)

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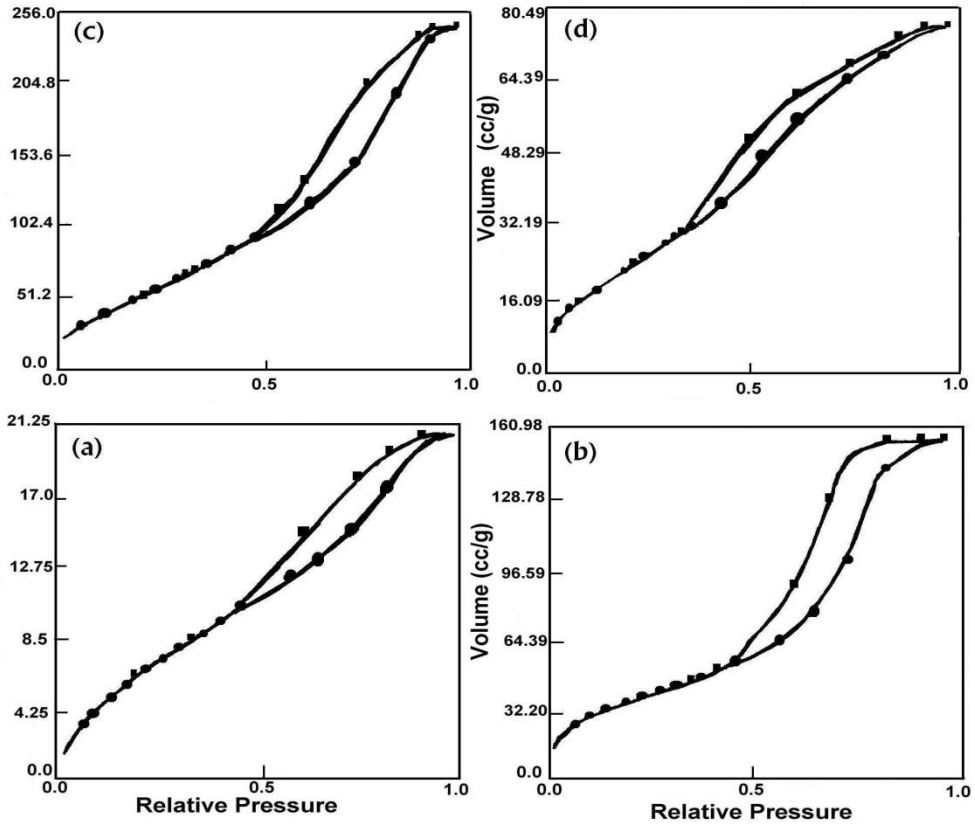

Fig. (6):N_2 Adsorption Isotherm of: (a) Molybdenum/alumina (b)Molybdenum/alumina* (c) Molybdenum/alumina – magnesia* (d) Molybdenum/alumina – chromia

All samples showed type IV isotherm of Brunauer classificationaccording to IUPAC classification[43]and exhibited H2 hysteresis loop.This kind of hysteresis loop was an indication for a network of interconnected pores with narrower parts (Fig.6). The S_{BET} values for the calcined catalysts were computed from linear plots of the S_{BET} equation.The adsorption isotherm for molybdenum/aluminacatalyst (Fig.6-a) showed small hysteresis and sharp decrease in surface area and pore volume as compared with barγ- alumina support. This decrease resulted from; bulky crystallites of ammonium heptamolybdate blocked some of alumina narrower pores and also accumulated on the walls of the wider ones, giving rise to a decrease in all surface properties.

Thermal treatment at 450°C for molybdenum/alumina catalyst produced an increase in S_{BET} (from 24.95 to 133.6 m^2/g), pore volume (from 0.0131 to 0.0713 cc/g), average pore radius (from 0.8016 to 1.400 nm) and microporosity % (from 9.9 to 16.87%). The effect was arising from the decomposition of incorporated ammonium heptamolybdate into smaller molybdenum-oxygen entities with removal of ammonia that produced the observed changes.

For calcined molybdenum/alumina-magnesia catalyst, a further increase in surface area was observed from 133.6 for calcined molybdenum/alumina to 240.2 m^2/g. This behavior indicated the modification of alumina-magnesia structure resulted from the interaction with molybdenum and formation of new oxide phases (in agreement with XRD and DSC data) which responsible for creation of new pores that contributed in the increase in surface area.Also, this increase is due to the formation of Mg $(OH)_2$ upon contact of MgO with water during incipient impregnation and its subsequent decomposition to high surface area MgO upon calcination, as reported by Mathew et al [44] .Meanwhile, accommodding molybdena particles in narrow pores cause some widening in these pores with an observable increase in pore volume. At the same time, some of these formed species mayagglomerate inside narrow pores and block some of them with a result of decreasing pore radius and microporosity%, (Table 4).

Table (4) : Surface Properties of the Prepared Catalysts

Catalyst	BETC constant	S_{BET} (m2/g)	S_t (m2/g)	V_p (cc/g)	r_H (nm)	m_f(%)
Alumina	65.04	170.80	164.54	0.0948	1.187	13.85
Mo/Alumina	28.06	24.95	15.64	0.0131	0.801	9.90
Mo/Alumina*	104.1	133.60	115.93	0.0713	1.400	16.87
Alumina-magnesia	73.36	209.7	233.37	0.1126	0.948	19.37
Mo/Alumina-Magnesia*	120.86	240.20	236.31	0.1880	1.050	13.80
Alumina-chromia	42.76	89.45	72.04	0.0504	0.891	16.25
Mo/Alumina-Chromia*	49.11	91.04	81.57	0.0507	0.831	18.24

*** is calcined catalysts**

Concurrently, for calcined molybdenum/ alumina-chromia catalyst, surface area showed a low value 91.04 m^2/g. This exactly related to formation of bulk crystallites of chromium and molybdenum oxide phases that covered different sites on the catalyst surface causing a blockage of pores and a decrease in surface area.In addition, the decrease in pore volume with the increase in m_f % (as compared with molybdenum /alumina-magnesia catalyst) is related to: these bulk crystallites densely accumulated on support pore walls to diminish its radius and consequently the calculated microporosity % was shown to be high (Table 4). Nickolov et al., [45] reported that, Mo-O entities are formed as tetrahedral monomeric MoO_4 and or octahedral polymeric -$[MoO_6]$-$_n$ surface species that interacted with chromium species formed bulk crystallites, in addition to bulk MoO_3 crystallites that caused semi blocking of alumina pores and provoked a decrease in surface area.

h) V_l-t Plot

To analyze isotherm of materials containing micro- and mesoporosity, t-method of de Boer et al.,[46] was applied. Theobtained $S_t$valuesshowedfair agreement with the corresponding S_{BET} values indicating a suitable choice of t-curves on the basis of the BET-C constant**.**For molybdenum/alumina catalyst, V_l-t plot (Fig.7) showed downward deviation at t >0.6 nm, thus the material was microporous one, but m_f % showed to be lower value (Table 4). This situation was because of blocking and accumulation of ammonium heptamolybdate species inside alumina pores and caused a decrease in Vp and $r_H$values and then a sharp decrease in surface area was observed. In addition, a very low adsorption volume (Fig.7) was observed, this accompanied with blocking of most of micropores with ammonium heptamolybdate species and their accumulation inside alumina mesopores to produce and leave small size of pores to measure. Thus, the downward deviation was not a result of creation of new micro pores as observed by small value of m_f %. After calcination, the material showed upward deviation because of destruction of ammonium heptamolybdate blocked the pores and removal of ammonia, in addition to the electrostatic repulsion created by charge adsorbed at the surface of particles. These two factors created an intracrystalline microporosity as clarified from the increase in m_f% and pore volume.

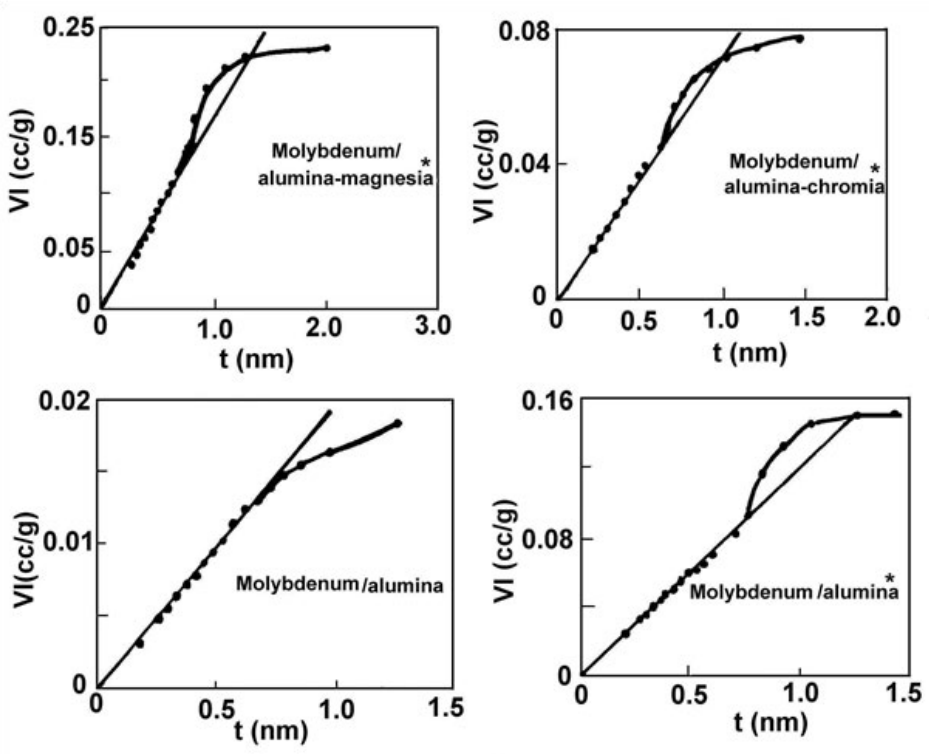

Fig. (7): V_l-t Plot for the Prepared Catalysts

Calcined molybdenum/alumina –magnesia catalyst (Fig.7) showed also upward deviation (capillary condensation)characterized mesoporous materials at t > 0.8nm with high value of adsorbed volume i.e. thermal decomposition of ammonium heptamolybdate facilitates accommodation of mesopores in catalyst. The slight decrease in m_f% and average pore radius and the increase in pore volume suggested generation of new deeper and slight wide mesopores that implies the dispersion of molybdenum species on support.Calcined molybdenum/alumina-chromia catalyst showed upward deviation at t > 0.6 nm but with a relatively low value of adsorbed volume. The decrease in V_p, r_H was explained on theaggregation of molybdenum inside support. Consequently, the increase in m_f % suggested the shrinkage of many crystals during calcination which did not create internal porosity.

IV. Conclusion

From the results described above, it can be concluded that the preparation of Mo catalysts using different composite oxide supports allow formation of different phases as established by using different techniques:

X-ray diffraction pattern detected the formation of Mg MoO_4 active site on using alumina-magnesia support. This phase characterized by its small crystallite size. Bulky crystallites of different molybdenum-chromium oxide phases were formed on using alumina-chromia support.

Differential scanning calorimetery analysis suggested that the support chemistry was responsible for the decomposition of ammonium heptamolybdate, consequently on alumina-magnesia support, the presence of basic MgO facilitate its decomposition and formation of magnesium molybdate. On other hand, its decomposition on alumina-chromia support (Cr_2O_3 was acidic support) caused formation ofbulk MoO_3, and polymolybdate species.Surface properties established that, the surface area of molybdenum/alumina-magnesia catalyst was the highest one compared with the other prepared catalysts.

Acknowledgement

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A Compensatory Fuzzy Approach to Vendor Selection

GJRE Classification (FOR) 170202, 080108

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Abstract **-Selection of vendor depends on price, quality, supply flexibility, replenishment lead-time, on-time performance etc. Hence supplier selection shall be viewed as multi-objective decision-making problem. Further, it requires an understanding of the vendor selection process and objectives under uncertainty. Fuzzy multi-objective programming model is formulated with procurement quantity as decision variable to take care of vagueness in the objectives. The objectives include minimizing the net cost, minimizing the quantity of raw materials rejected and minimizing the quantity of late deliveries. In this paper, Werner's compensation operator (γ) is adopted to aggregate the multi-objectives to generate a compromise solution which is both compensatory and Pareto-optimal. Finally, two numerical examples of vendor selection from the literature are considered and illustrated to explain the approach**

Keywords-Multi-objective Decision Making, Membership function, Procurement, Vendor selection, Compensation Operator.

I. INTRODUCTION

In today's competitive operating environment it is impossible to successfully produce low cost high quality product without a satisfactory vendor (Weber et al., 1991). Classical optimization techniques evaluate vendor performance based on single criteria. But realistic situations involve so many objectives and constraints for selection. Goal programming and Fuzzy goal programming are among the techniques used for solving problems with multiple objectives and constraints. The review of literature in relation to the multi-criteria/ objective decision-making approaches to vendor selection problems are discussed in this section.Weber et al. (2000) discussed a structured approach to vendor selection problem. Gao et al. (2003) established a multiobjective linear programming model for the special issues of purchasing bulk raw materials of large scale steel plant. Manoj kumar et al. (2004) formulated vendor selection problem as a fuzzy mixed integer goal programming problem. Venkata Subbaiah and Narayana Rao (2004) adopted AHP for supplier selection with thirty three sub-criteria under six main criteria in four decision hierarchy levels.Araz et al. (2006) developed an outsourcer evaluation and management system for a textile company by use of fuzzy goal programming (FGP). Amid et al. (2006) developed a fuzzy multi-objective linear model for a supplier selection problem, to overcome the vagueness of the information involved in the selection process. Chen-Tung Chen et al. (2006) presented fuzzy approach for supplier evaluation and selection in supply chain management.Yuan Chen et al. (2006) adopted fuzzy multi objective programming approach for vendor selection in iron & steel enterprise. Narayana Rao et al. (2007) applied fuzzy outranking technique for selection of supplier. Ketata et al. (2008) proposed a new approach based on the integration of the FAHP with the fuzzy goal programming. Sreekumar et al. (2009) proposed fuzzy multi-criteria decision making approach (Fuzzy AHP) for selection of vendor in supply chain environment. Satyanarayana raju et al. (2009) considered supplier selection problem as multi-objective decision making problem and formulated through fuzzy goal programming approach. Tsai et al. (2009) proposed a fuzzy goal programming approach that integrates activity based costing and performance evaluation in value chain structure for optimal green supply chain supplier selection and flow allocation.

II. MULTI-OBJECTIVE APPROACH TO VENDOR SELECTION

One of the most important processes performed in the organizations today is the evaluation, selection and continuous improvement of vendors. Outstanding vendor performance normally requires extensive communication and cooperation between buyer and supplier over a period of time. In comparison to the hardnosed way of procurement of earlier days, the ideas of sharing information and assisting vendor to improve quality, quantity, delivery, price and service performance are now prevalent. Vendors are the best intangible assets of any organization. Hence selecting the right bunch of suppliers is extremely important. The buyer must have a clear idea of rating vendors and improve relations with them. The rating can also be used as a feed back to the suppliers for improving the products and services. However, one has to follow a selective policy and choose that are suitable to his needs.In general, the environment that governs the vendor selection is highly influenced by the variables, which are vague in nature creating uncertainty in the formulation of the objective functions. Hence, the objective functions may be assumed as fuzzy goals. Linear membership function may be adopted for all the fuzzy goals. The methodology adopted in developing the vendor selection model in fuzzy environment facilitates simultaneous aggregation of fuzzy goals under specified constraints. In fuzzy environment, fuzzy goal programming approach may be adopted with two

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aggregating operators (Minimum&Fuzzy compensation).Min operatorfocuses on the maximization of the minimum membership grade. It assures compensatory decisions. In this paper, vendor selection model is formulated using fuzzy compensation operator to trade off the conflicting goals.

III. METHODOLOGY

The following steps explain the formulation and complete solution procedure for multi-objective vendor selection problem in fuzzy environment.

STEP 1: Identification of the objectives.

Vendor selection depends on various objectives namely minimization of net cost, rejected quantity, delayed items, maximization of collaboration capability etc. The objectives are formulated basing on the criteria like price, quality, on-time performance, lead time, supply flexibility etc. In this thesis, minimization of net cost (Z_1), rejected quantity (Z_2) and delayed quantity (Z_3) are considered for vendor selection. The mathematical formulations of the objectives are shown below.

$$\min Z_1 = \sum_{i=1}^{m}\sum_{j=1}^{n} P_{ij} * X_{ij} \quad (3.1)$$

$$\min Z_2 = \sum_{i=1}^{m}\sum_{j=1}^{n} Q_{ij} * X_{ij} \quad (3.2)$$

$$\min Z_3 = \sum_{i=1}^{m}\sum_{j=1}^{n} R_{ij} * X_{ij} \quad (3.3)$$

STEP 2: Identification of the Constraints.

In vendor selection problems, the purchasing quantity of particular material depends on various constraints of the organization. The constraints may be demand, budget, technical proportion, supply elasticity, capacity of vendors, flexibility, service level, number of orders, appraised rating etc. The mathematical formulations of the constraints are shown below.

Demand: $\sum_{i=1}^{m} X_{ij} >= D_j \quad j = 1,2,...n$ (3.4)

Budget: $\sum_{i=1}^{m} P_{ij} X_{ij} <= B_j \quad j = 1,2,...n$ (3.5)

Technical Proportion:

$$\sum_{i=1}^{m} X_{ig} = A_{gh} \sum_{i=1}^{m} X_{ih} \qquad g,h \in 1,2,...n \ , g \neq h \quad (3.6)$$

Supply elasticity: $\sum_{i=1}^{m} \xi_{ig} * X_{ij} <= E_j \qquad j = 1,2....n$ (3.7)

Capacity of vendors: $X_{ij} <= U_{ij} \qquad i = 1,2...m \ \ and \ \ j = 1,2....n$ (3.8)

Flexibility: $\sum_{i=1}^{m} f_{ij} * X_{ij} \geq f_j * D_j$ (3.9)

Appraised Rating $\sum_{i=1}^{m} g_{ij} * X_{ij} \geq g_j * D_j$ (3.10)

Service Level $\sum_{i=1}^{m} s_{ij} * X_{ij} \geq s_j * D_j$ (3.11)

Single Order from same vendor: $y_i \leq \sum_{j=1}^{n} y_{ij} \leq m * y_i$ (3.12)

Positive Restriction: $X_{ij} \geq 0 \qquad i = 1,2...m \ \ and \ \ j = 1,2....n$ (3.13)

STEP 3: Obtaining the extreme solutions

Extreme solutions of the objectives are obtained by optimizing individual objectives subjected to the given constraints. These solutions are useful in setting up the aspiration levels. The single objective linear programming problems can be solved using LINGO 8.0 solver and determine the higher and lower aspiration levels of the objectives.

STEP 4: Formulation of Membership functions

Membership functions of fuzzy objectives are now defined from the extreme solutions. The linear membership function of fuzzy objective net costis shown below. Similar membership function for rejected and delayed quantity may be formulated.

i) Membership function

$$\mu_{Z_1} = 1 \quad \text{if } Z_1 \leq Z_{L1}$$
$$= \frac{Z_{H1} - Z_1}{Z_{H1} - Z_{L1}} \quad \text{if } Z_{L1} < Z_1 < Z_{H1}$$
$$= 0 \quad \text{if } Z_1 \geq Z_{H1} \quad (3.14)$$

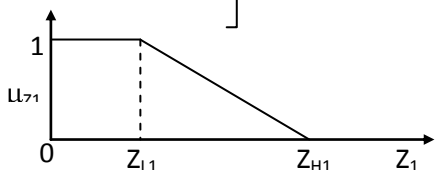

Figure 3.1: Membership Function of Net Cost

STEP 5: Formulation of mathematical model

A Mathematical model is formulated by using Werner's compensation operator (μ_{and}) which is shown below.

$$\max \mu_{and} = \lambda + \frac{(1-\gamma)}{P}(\lambda_1 + \lambda_2 + ... + \lambda_p)$$

$$\text{s.t}$$

$$X \in S$$

$$\mu_p(F^p(X)) \geq \lambda + \lambda_p$$

$$\lambda + \lambda_p \leq 1$$

$$\lambda, \forall \lambda_p \in [0,1], \quad p = 1,2,...p$$

$$\gamma \in [0,1]$$

(3.15)

And also subject to the given constraints.

STEP 6: Obtaining the Solution

Solve the mathematical model using LINGO Solver of LINDO systems to determine right vendor and allocate the quota to the vendor.

STEP 7: Analysis of the results

By analyzing the results, the organization is able to purchase different materials from the right vendor in right quantity.This approach provides a better way to select vendors and optimizes procurement quota allocation for decision makers.

IV. ILLUSTRATIVE EXAMPLE

Fuzzy goal programming approach to vendor selection with the compensation operator is explained with two numerical examples (Yuan Chen et al., 2006;Zhimin Guan et al., 2007). In this section, a numerical example from Yuan Chen et al. (2006) is considered. A certain Iron and Steel Enterprise need to select two materials from four vendors. The related information about the organization and vendors are displayed by table 4.1 and table 4.2 respectively.

Table 4.1 Constraints Data of the Organization

Material (j)	Demand (Dj) (10^4 ton)	Budjet (B_j) (10^4¥)	Technical Proportion (a_{gh})
1	8000	90000	2
2	6000	60000	

Table 4.2 Data of Vendors

Vendor (i)	Material (j)	P_{ij} (Price)	Q_{ij} (Rejected fraction)	R_{ij} (Delayed fraction)	ξ_{ij} (Supply Elasticity)	U_{ij} (Capacity)
1	1 2	11 7	0.06 0.04	0.12 0.09	0.5 0.3	10000 15000
2	1 2	- 6	- 0.05	- 0.1	- 0.4	- 10000
3	1 2	12 5	0.07 0.08	0.03 0.12	0.4 0.8	15000 9000
4	1 2	12 -	0.05 -	0.11 -	0.11 -	8000 -

a) Objectives & Constraints

In this model, objectives namely minimization of net cost, quantity of rejected items and quantity of delayed items are considered as discussed in step '1' of methodology section. Constraints includerestrictions due to the overall demand of each item, restrictions on budget amount for each item, restrictions on technicalproportion among some special items, flexibility needed withthe vendors' quota and restrictions on the maximum capacity of the vendors as discussed in step '2' of methodology section.

b) Extreme Solutions

Extreme solutions of the three objectives are obtained by optimizing individual objectives subjected to the given constraints. These solutions are useful in setting the aspiration levels. The following table shows the extreme solutions.

Table 4.3 Extreme solutions

Objective function	Net cost (million ¥)	Rejected Quantity (million tons)	Delayed Quantity (million tons)
Net cost (Z_1)	16.46	11.74	21.34
Rejected Quantity (Z_2)	18.20	8.80	19.00
Delayed Quantity (Z_3)	18.20	10.26	13.51

Determine the higher and Lower aspiration levels of the objectives: Higher and lower aspiration levels of the objectives are shown below.
$Z_{1min} = 16.46$; $Z_1max = 18.20$; $Z_{2min} = 8.80$; $Z_{2max} = 11.74$;
$Z_{3min} = 13.51$; $Z_{3max} = 21.34$;

i. Membership function of Net Cost:

$$\mu_{Z_1} = 1 \quad \text{if } Z_1 \le 16.46$$
$$= \frac{18.20 - Z_1}{18.20 - 16.46} \quad \text{if } 16.46 < Z_1 < 18.20$$
$$= 0 \quad \text{if } Z_1 \ge 18.20 \qquad (4.1)$$

ii. ii) Membership function of Rejected Quantity:

$$\mu_{Z_2} = 1 \quad \text{if } Z_2 \le 8.80$$
$$= \frac{11.74 - Z_2}{11.74 - 8.80} \quad \text{if } 8.80 < Z_2 < 11.74$$
$$= 0 \quad \text{if } Z_2 \ge 11.74 \qquad (4.2)$$

iii. iii) Membership function of Delayed Quantity:

$$\mu_{Z_3} = 1 \quad \text{if } Z_3 \le 13.51$$
$$= \frac{21.34 - Z_3}{21.34 - 13.51} \quad \text{if } 13.51 < Z_3 < 21.34$$
$$= 0 \quad \text{if } Z_3 \ge 21.34 \qquad (4.3)$$

d) Model Formulation with Compensation Operator

Mathematical Model: Mathematical model is formulated using compensation operator (Werner, 1988) and shown below.

$$\text{Max } \mu_D(x) = \lambda + \frac{1}{3}(1-\gamma)(\lambda_1 + \lambda_2 + \lambda_3) \qquad (4.4)$$

Subject to the constraints (3.12 to 3.21).

c) Formulation of Membership Functions

Membership functions of fuzzy objectives are defined from the extreme solutions. The membership functions of fuzzy objectives are shown below.

The above model is solved using LINGO Solver of LINDO systems to determine right vendor and allocate the quota to the vendor.

e) Discussion of results

Procurement plan obtained with min operator adopted by Yuan Chen et al. (2006) and compensation operator is

presented in table 5.1. Procurement plan indicates the procurement quantities of the materials from the vendors.

Table 4.4 Procurement of materials.

Vendor (i)	Material (j)	Procurement Quantity (millions)			
		Minimum Operator (Yuan Chen et al. 2006)	Compensation Operator (Proposed Method)		
		λ	0≤γ<0.4	γ=0.4	0.4<γ≤1.0
1	1 2	60.00 33.18	60.00 0.0	60.00 0.0	68.74 0.0
2	1 2	- 0.0	- 72.73	- 70.24	- 71.58
3	1 2	20.00 39.55	20.00 0.0	30.00 2.48	11.26 1.149
4	1 2	0.0 -	0.0 -	0.0 -	0.0 -

The objective values obtained with fuzzy compensation operator are shown in table 5.2. The results indicate that net cost (1326.47) and rejected quantity (8.58) is minimum, for 0.4<γ≤ 1.0. The objective of delayed quantity is minimum (15.07) for 0≤γ<0.4. The results help the decision maker in selecting the grade of compensation depending upon the relative weightage of objectives.

Table 4.5 Comparison of Net cost, Rejected Quantity and Delayed Quantity

Model	Operator	Net cost (million ¥)	Rejected Quantity (million tons)	Delayed Quantity (million tons)
Compensation operator (Proposed Method)	0.0<γ≤0.4	1336.36	8.64	15.07
	γ=0.4	1333.88	8.71	15.12
	0.4<γ≤1.0	1326.47	8.58	15.88
Minimum operator (Yuan Chen et al. 2006)	λ	1330.00	9.49	15.53

Net cost is minimum (1326.47) for 0.4<γ≤1.0. If minimization of net cost is the most important objective than the other objectives for the organization, the compensation operator value 0.4<γ≤1.0 may be adopted. Solution obtained for 0.4<γ≤1.0 is preferred if minimization of the rejected quantity is the most important objective to the organization and corresponding procurement plan is considered. Further, Solution obtained for 0.0<γ<0.4 is preferred if minimization of delayed quantity is the most important objective for the enterprise.

V. Conclusion

Vendor selection is an important function for any enterprise. It is a complex decision making process involving multiple objectives. In this study, a compensatory fuzzy approach is proposed for selection of vendors. This approach provides a better way to select vendors and optimize procurement quota allocation for decision makers.

In this study, a numerical example is considered and solved through compensatory fuzzy approach. The results of the proposed approach are compared with the results obtained by minimum operator and weighted fuzzy model. It indicates that the proposed approach yields a compromise solution which is both compensatory and Pareto–Optimal. Further, the decision maker can implement suitable procurement plan depending upon the priority of the objectives. In this thesis, three objectives namely, net cost, rejected quantity and delayed quantity are considered. This study can be extended to other objectives like business relations, lead time, Collaboration capability etc. In addition, the crisp constraints considered in the study may be treated as fuzzy constraints in the model formulation.

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Design & Analysis of H-Shape Microstrip Patch Antenna

GJRE Classification (FOR) 100501, 291701

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Abstract- **In this paper, the characteristics of a small antenna using an H-shaped microstrip patch antenna are analyzed. Operating frequency of H-shaped microsrip antenna is 2 GHz. The theoretical results are compared with experimental result using cavity model. Comparison with other reported results justify the veracity of the proposed method. Significant reduction of antenna size can be realized when the H-shaped patch is used instead of the conventional rectangular microstrip patch antenna. The designed antenna is simulated by using IE3D software. A comparison between the simulation and MATLAB result is shown. Good agreement with the experimental results is demonstrated.**

Keywords- Microstrip antenna, H-shape patch, Cavity model, IE3D software.

I. INTRODUCTION

Microstrip antennas [1] are mostly used for aerospace applications because of their low weight, low volume and conformal nature. The most commonly used microstrip antennas are rectangular and circular disc antennas. However, other microstrip antennas are also being considered, depending on the application. Here we report two alternatives to the rectangular patch antenna.

The H-shaped patch antenna [2] reported here has a size about half that of the rectangular patch, with larger beam-width but smaller bandwidth. On the other hand, the rectangular ring antenna has smaller size, larger bandwidth and narrow beam-width. The H-shaped microstrip patch antenna, because of its considerably smaller size, could replace the rectangular patch at UHF frequencies. When they are applied in the frequency range below 2 GHz, the sizes of conventional rectangular microstrip patches seem to be too large.

II. DESIGN OF H-SHAPE MICROSTRIP PATCH ANTENNA

The H-shaped microstrip antenna [7] consists of an H shaped patch; supported on a grounded dielectric sheet of thickness h and dielectric constant εr the physical dimensions of the H-shaped microstrip patch antenna are shown in Fig.1.The and two identical conductor strips with length L4 and width on both sides. The feed point is located at the point (L_1, W_1).

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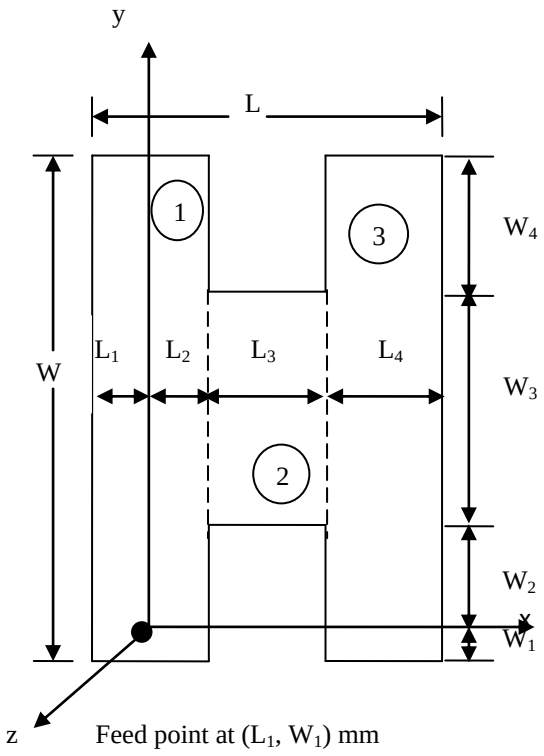

Fig.1. H-shaped Patch Antenna with Parameters L=36.26 mm, W=46.51mm, L_3=16.26 mm, L_4=10 mm, W_3=26.51 mm, Frequency f=2 GHz, ε_r =4.2, h=1.6mm

III. METHOD OF ANALYSIS

Transmission line model [11] represents the microstrip antenna by two slots, separated by a low impedance Z_c transmission line of length L. This method includes the dielectric constant of the substrate (ε_r), resonant frequency (f_r) and the height of substrate h. For low frequencies the effective dielectric constant is essentially constant. It is given by

$$W/h \geq 1 \qquad (1)$$

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-1/2} \quad (2)$$

Actual length L of the patch can be determined by the following formula

$$L = \frac{1}{2f_r\sqrt{\varepsilon_{reff}}\sqrt{\mu_0\varepsilon_0}} - 2\Delta L \quad (3)$$

For an efficient radiator, a practical width that leads to good radiation efficiencies is

$$W = \frac{1}{2f_r\sqrt{\mu_0\varepsilon_0}}\sqrt{\frac{2}{\varepsilon_r+1}} \quad (4)$$

$$W = \frac{v_0}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}} \quad (5)$$

$$f_r = \frac{1}{2L\sqrt{\varepsilon_r\sqrt{\mu_0\varepsilon_0}}} \quad (6)$$

Boundary condition for region-1

$$-L_1 \le x \le L_2 \quad (7)$$

$$-W_1 \le y \le W - W_1 \quad (8)$$

$$0 \le z \le h \quad (9)$$

Boundary condition for region-2

$$L_2 \le x \le L_2 + L_3 \quad (10)$$

$$W_2 \le y \le W_2 + W_3 \quad (11)$$

$$0 \le z \le h \quad (12)$$

Boundary condition for region-3

$$L_2 + L_3 \le x \le L - L_1 \quad (13)$$

$$-W_1 \le y \le W - W_1 \quad (14)$$

$$0 \le z \le h \quad (15)$$

Electric field equations for H- shape microstrip antenna

$$E_x = -j\frac{1}{\varpi\mu\varepsilon}k^2\cos\left(\frac{\pi}{h}z'\right) \quad (16)$$

$$E_y = -j\frac{1}{\varpi\mu\varepsilon}k^2\cos\left(\frac{2\pi}{h}z'\right) \quad (17)$$

$$E_z = 0 \quad (18)$$

Magnetic field equations for H- shape microstrip antenna

$$H_x = -\frac{4\pi}{\mu h}k^2\sin\left(\frac{2\pi}{h}z'\right) \quad (19)$$

$$H_y = -\frac{\pi}{\mu h}k^2\sin\left(\frac{\pi}{h}z'\right) \quad (20)$$

$$H_z = 0 \quad (21)$$

IV. Experimental Setup

Fig.2.Shows that the experimental setup for the determination of the return loss of the proposed antenna. In this experiment the designed antenna is connected to the SWR bridge (50Ω, 5-3000 MHz) and this is attached to the analyzer of range 0-3 GHz .This analyzer determined the return loss of the designed H-shaped microstrip patch antenna and demonstrates the return loss versus frequency

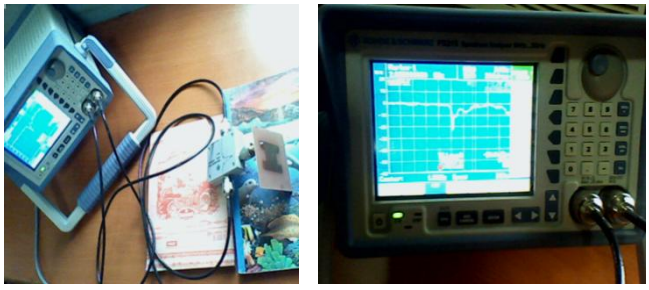

Fig. 2. Experimental setup

V. Discussion & Results

We have designed the H-shaped Microstrip Patch Antenna at frequency 2 GHz. The resonant frequency of the antenna is 1.99 GHz. A comparison between the simulation and MATLAB result is shown in Fig. 3 & 4. This Patch Antenna is simulated by IE3D software, version 12.6. We have observed that from following Fig. 3. Shows that return loss with frequency of antenna is found to be -30.33 dB at resonant frequency 1.99 GHz. Fig. 4. Shows that return loss -10.5 dB of the proposed antenna using the Matlab.

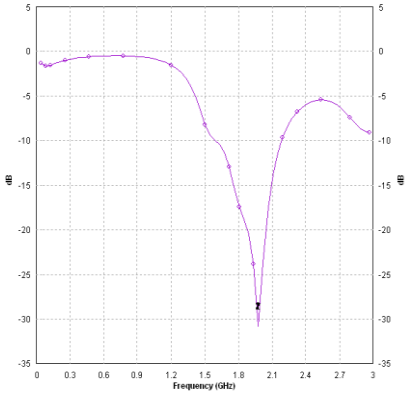

Fig.3. Return loss of proposed antenna at f 1.99 GHz

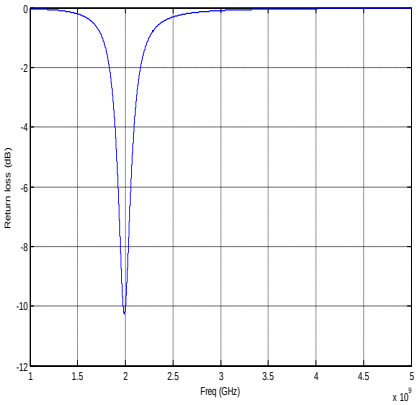

Fig.4. Return loss of proposed antenna using MATLAB at f=1.99GHz

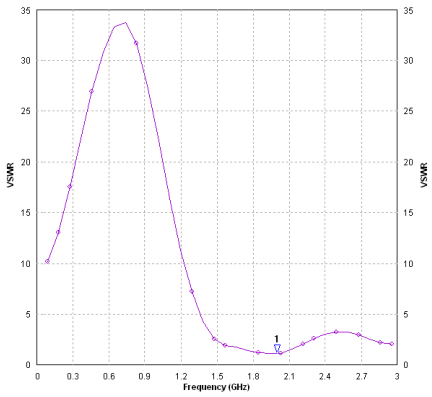

Fig.5. VSWR with frequency of antenna

Designed antenna is resonant at frequency 1.99 GHz gives the total field properties as Gain: 11.3677 dBi, Directivity: 7.28714 dBi, 3dB Beam Width: 74.1333, 114.927 deg, Incident Power: 0.01 W, Input Power: 0.00999073 W, Radiated Power: 0.000136305 W, Radiation efficiency: 1.36431%.

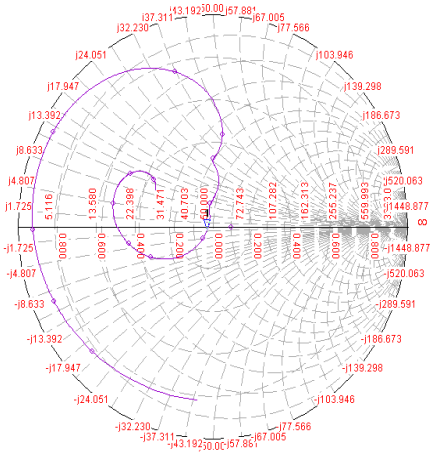

Fig.6. Smith chart of the proposed antenna

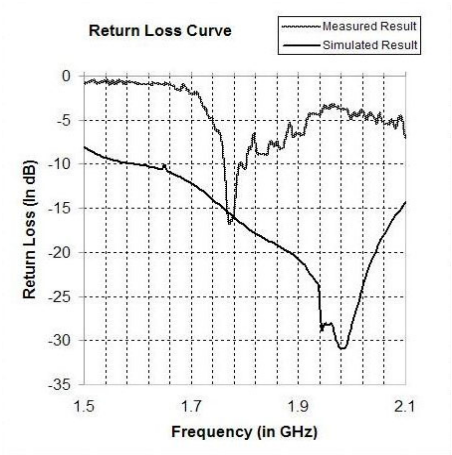

Fig.7. Comparison of Simulated & Measured result

At all centre frequencies value of VSWR 1.078 at 1.99 GHz which is less than 2 is shown in Fig. 5. Smith chart which is a polar plot of the of the complex reflection coefficient determine the input impedance of the designed antenna in our simulated result it is closed to 50 ohms is shown in Fig. 6.Fig.7.Shows that the comparison of simulated and measured result in simulated result return loss is found to be

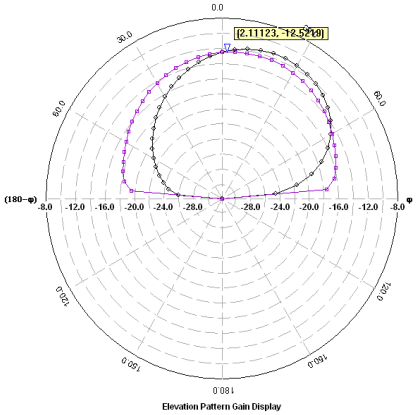

Fig.8. Simulated 2-D radiation pattern at f=1.99 GHz

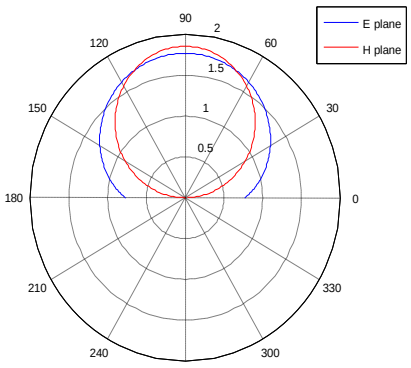

Fig.9. Radiation pattern using MATLAB

-30.33dB at resonant frequency 1.99 GHz while in measured result return loss is obtained -16.6dB at f_r =1.77 GHz. Since a microstrip patch antenna radiates normal to its patch

surface, the elevation pattern for $\varphi=0^0$ and $\varphi=90^0$ would be important this is shown in Fig. 8 & 9.

VI. Conclusion

We have concluded that the characteristics of a small antenna using an H-shaped microstrip patch antenna are analyzed. Based on the cavity model resonant frequencies with respect to different antenna parameters are studied. This antenna is alternative to the rectangular microstrip antennas. The Simulation has been performed using the IE3D software to determine the various parameters of antenna. Good agreement between the simulations and measurements has been achieved on proposed antenna.

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Application of Information Technology in Business Process of Power Utilities

Utkarsh Seetha[1], R. V. Kataria[2]

GJRE Classification (FOR) 150302

***Abstract*-MBC, R-APDRP, Discom, SOA, CRM, O&M, CIS, OLAP, MOSS, Firewall, SAN, Intranet, Data Layer, IVRS, CA IAM, Web Clients, MIS, Business Intelligence**

I. Objective

The purpose of this research is to bring the details of the business process requirements of IT Package. This research details the project requirements, which are to be met by the applications and interfaces required between different hardware and software systems. The objective of this research includes the software solution, availability, readiness for metering, billing, collection (MBC) and several other business processes of the utilities.

II. Overall solution description

This solution serves the applications/modules for the purpose of the Subdivision Automation of State Electricity Departments in respect to the business functionality. This solution covers the functionality as mentioned and required in the Document as this is an advanced engineered office management tool. It is developed to manage all types of useful databases, analyzes them by applying standard concepts and implement them in a manner consistent with its purpose or design the logic of electrical engineering and subdivision level management in a modernize way.After a deep study of RAPDRP requirements and the difficulties of DISCOMs, our research has suggested the solution with additional amenities. DISCOMs related business functionality would be customized in the product on the base of the Document.The solution has the capability to integrate with other Business Process Applications as per the requirement captured in system study and suggested by Document. The integration architecture of this solution is based on SOA (Service Oriented Architecture) and due to this it is easily mapped with the integration middleware for exposing the business functionality to external systems as well as to consuming the business functionality of external systems.

Features:

Flawless Integration of Functions and Processes
Increase Operation Efficiency
Process Streamlining
Enhance Customer Service
Business Assessment Support for Strategic Issues
Revenue Augmentation
Scalability, Flexibility for future application integration

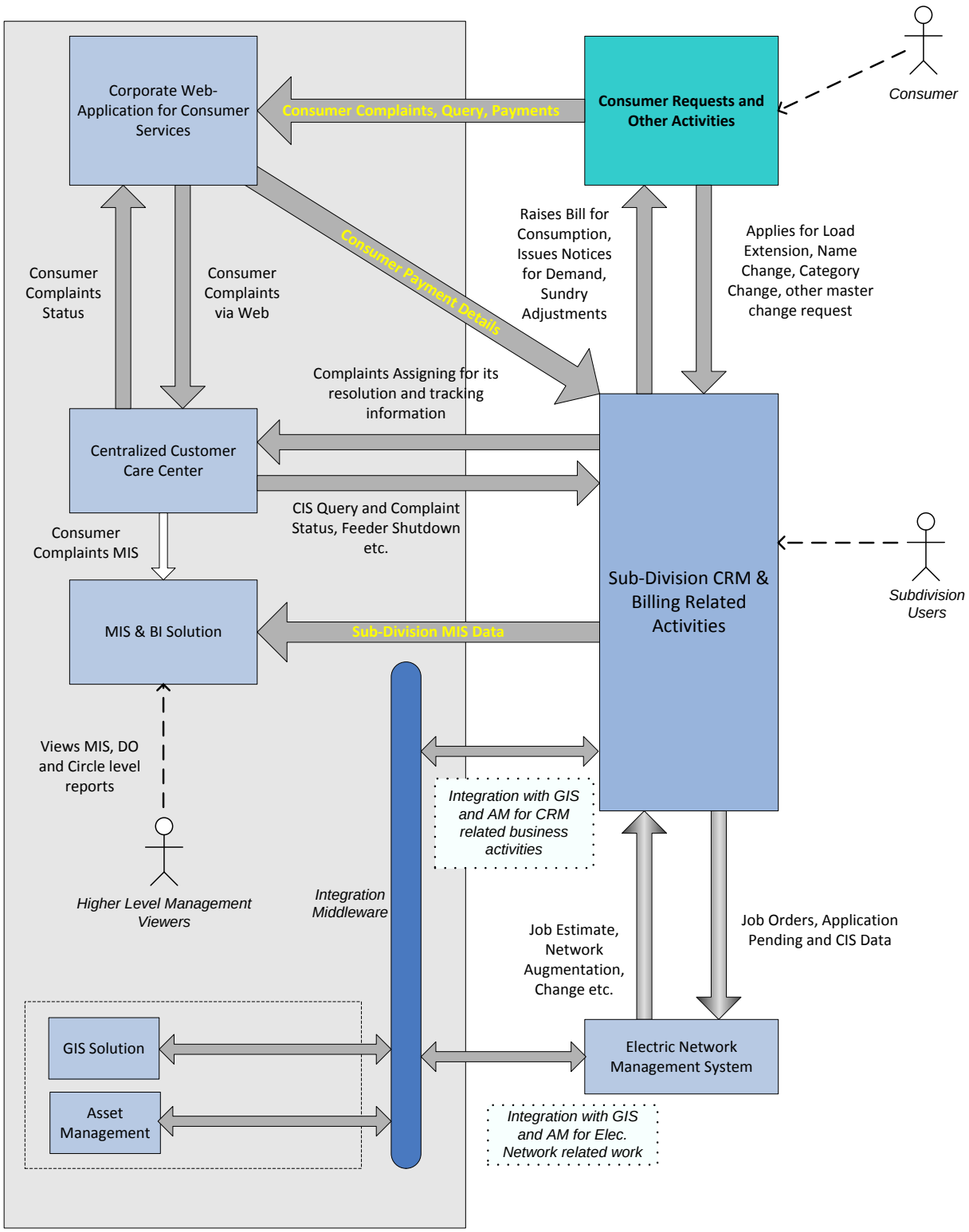
III. Solution overview & context diagram

The solution has the following applications which contain the business functionality for the Subdivision Automation of Discoms:

1) CRM
a) Request Management
b) Consumer Section
c) Collection Management
d) Technical Section
e) Estimation Section
f) Metering Section
g) Revenue Management
h) Technical Complaint Center
i) Commercial Complaint Center
j) Subdivision MIS
k) A.En Sectio

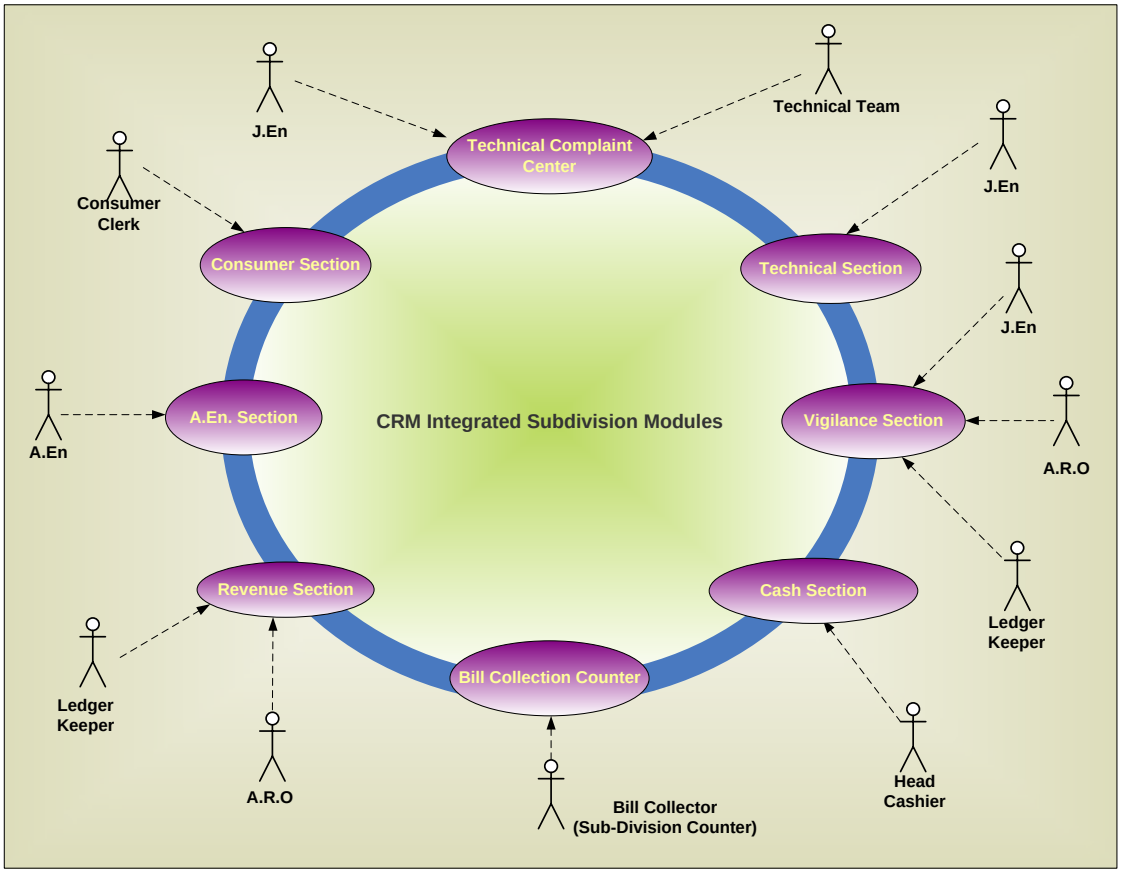
About[1]-Restructured Power Development and Reforms Programme, Rajasthan
About[2]-Current Department/Project

System Context Diagram for CRM
The diagram gives an overall view of the CRM functionalities.



IV. CRM PERSPECTIVE

This solution is mainly used for the purpose of the subdivison level business functionality. Following diagram shows the mapping of the subdivision modules with the subdivsion level actors/role.

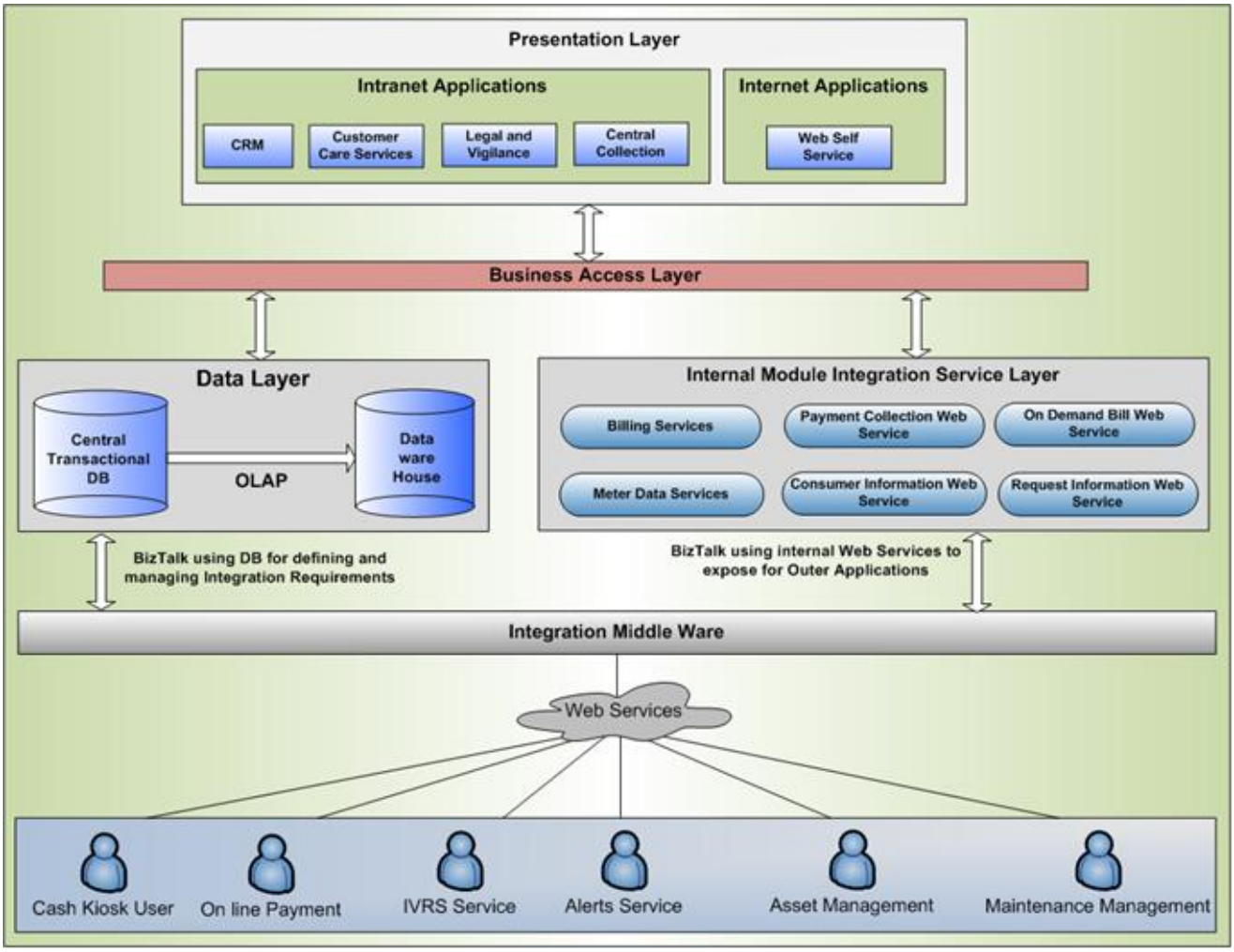


The present working system of distribution wing (O&M) of DISCOMs covers various activities spanning in Sub-Division's various departments. The functionality includes the consumer related work of Sub-Division i.e. Consumer information system (CIS), creation of new consumers, work related to existing and prospective consumers, preparation of priority and master register etc. Cash related work of Collection, preparation of cash books, budget and expenditure control register etc. Revenue related activities like service connection, meter change, disconnection, reconnection orders, preparation of ledgers, preparation of monthly assessment and realization details, preparation of monthly account etc.All store and inventory management related activities like receipt, issue and accounting of material / expenditure, meter movement, optimum planning etc. is made at the J.En. level. All Sub-Division activities like Estimation, Compliance of Job, New Service Connection, Meter Change, Disconnection, and Reconnection orders. Preparation of material at site accounts, accounting of material / assets etc. It will have a MIS Section to view the reports related to Subdivision working.

Following are the departments, a normal Sub-Division (Operation) has. All the functionality mentioned below would be covered by this application / module The CRM application will handle processes related to:

Revenue Section
Cash Section
J.En. Section
Consumer Section
A.En. Section
Complaint Section
Field Staff

Architecture Diagram for CRM application



V. PORTAL AND DOCUMENT MANAGEMENT

This section describes at a high level the scope of the portal and DMS .It attempts to put this system functionality within three contexts. First, it identifies as a project of Intranet Portal Solution purely developed in Microsoft Office SharePoint Server. Second, it provides a brief overview of the project and third it describes the system context in terms of its sub-components.

Identification: It is a complete portal solution for intranet users of R-APDRP to initiate the various departments related permitting activities and facilitate to store and access various regulatory information, permitting resources on this site based on their permissions.

Brief Overview: The goal of this entire solution is to customize and publish as a separate common portals(for each discom) which provides the intranet users with a user friendly interface and guide them to navigate to the appropriate web pages and sites.

It provides an interface for the users that help them to identify the appropriate documents of various departments and direct them to a set of standard and consistent home pages for various verticals by enforcing a common look across the sites. These websites provides the access to various permitting information and the user can then perform the various permitted tasks available.

The System includes a search facilities for access the whole the site contents and have an advanced search to provides user to access the various file servers and virtual source safe servers and different sites content of both intranet and internet.

The System includes the built-in administration environment to manage the websites and web pages. The application is built using Microsoft Office SharePoint Server with SQL Server as a backend data store for all solution content.

System context: The System consists of mainly five subsystems:The Portal web application The main web application that provides a set of websites with static pages and dynamic web pages with a consistent look and feel.

SQL Server SQL Server relational database used to maintain the entire content sources and configuration sources of all the sites of MOSS.

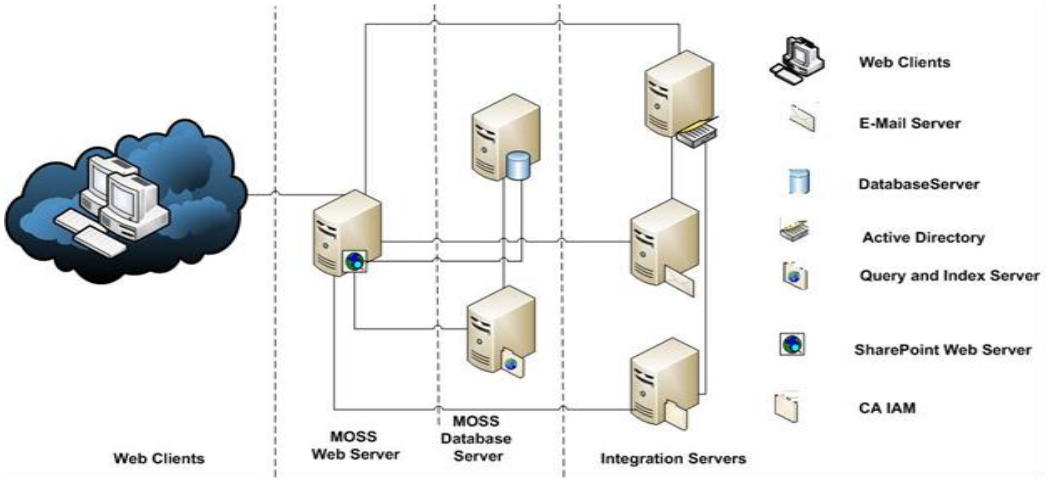
Active Directory- It's a distributed database that store and manages information about network resources, as well as application specific data from directory enabled applications.

CA IAM- Its provides a single sign on functionality to access the portal and other applications which are integrated with the portal.

Exchange Server This server provides E-mailing solutions. It would be integrated with Portal for notification and alerts service

.

System context diagram:



The high-level deployment architecture of the proposed solution implemented using Microsoft Office SharePoint Server with a full blown high availability solution without a single point of failure is visualized as below.

From the picture (Figure 1) it is evident that the overall solution architecture in Data Centre comprises of

3 Active Directory Servers (Primary and Additional Domain Controllers)

4 MOSS Servers (with 2 windows NLB, 1 Application Server, 1 Index Server)

2 SQL Servers on Active-Passive configuration

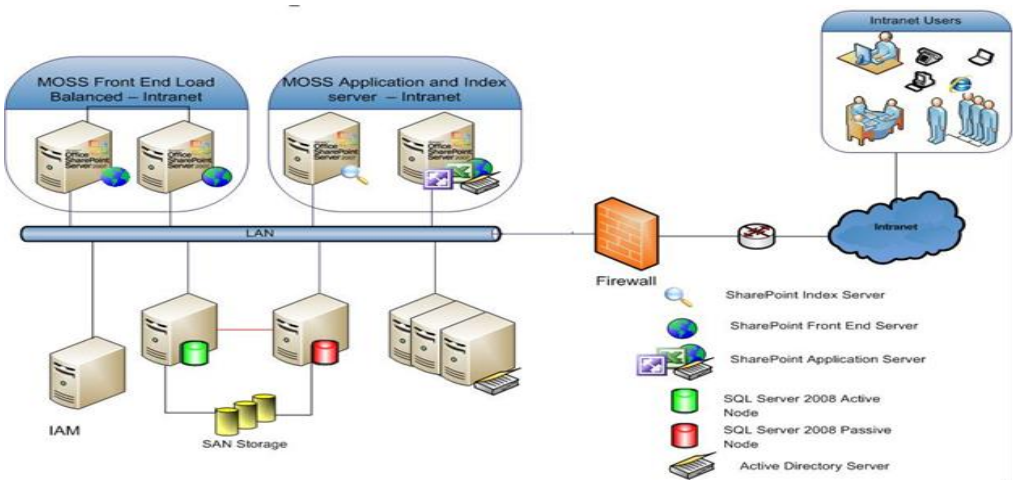


Figure 1: Overall Portal Solution Architecture in Data Centre (DC) Si

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Investigation of Natural Convection inside an Inclined Porous Square Cavity with Two Wavy Walls

GJRE Classification (FOR) 020304

Khudheyer S. Mushatet

Abstract: **In this paper, the natural convection hat transfer and fluid flow in an inclined wavy porous cavity has been numerically studied. The two wavy walls were differentially heated while the upper and lower wall was insulated. A curvilinear coordinates generation system was used to transfer the physical space into a computational one. The governing equations were reduced to stream function and energy equation by using the dimensionless analysis. The stream function equations was solved by using iteration method while the energy equation with an alternate difference implicit scheme (ADI). The problem was simulated for different values of angle of inclination ($0 \le \alpha \le 90$) and Rayleigh number ($50 \le Ra \le 500$). The conducted computed results show that the angle of inclination, the number of undulation, the amplitude and Rayleigh number have a significant effect on the flow and thermal field. Also it was found that the rate of heat transfer increases as angle of inclination increases and decreases as number of undulation increases. The present code used for handling the considered problem was validated with published results.**

Nomenclature

A amplitude
g gravitational acceleration, m/s^2
H height of the cavity wall, m
J Jacobian of the transformation
K permeability, m^2
Nu local Nusselt number
Nu_{av} average Nusselt number
Ra Rayleigh number
T_c cold wavy wall temperature,Ċ
T_h hot wavy wall temperature, Ċ
u,v velocity components, m/s
x,y Cartesian coordinates, m
X, Y dimensionless Cartesian coordinates
α, β ,γ,τ,σ Transformation parameters in grid generation
ξ,η coordinates in the transformed domain
ψ stream function, m^2/s
Ψ dimensionlessstream function
ρ density, Kg/m^3
a thermal diffusivity, m^2/s
α angle of inclination, deg.
θ dimensionless temperature

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I. Introduction

The subject of natural convection heat transfer in an enclosed enclosure is considered an alternative for many researchers. This interest arises from its important application in many engineering fields such as solar collectors, cooling of electronic devices and nuclear reactors. When reviewing the related previous studies, one can find most of the researches were concentrated on rectangular or square enclosures for both porous or non-porous medium. So few studies were found on natural convection in a complex-shaped enclosures such a wavy enclosure(i.e. non-rectangular enclosure). The natural convection heat transfer inside a wavy enclosure was motivated by the researchers in the recent years because of its implications in some technological applications such as geophysics and heat exchanger design. In this section an insight is to be get on the previous studies. Braden et al. [1]used the Darcy model and Boussinesque approximation to study the natural convection inside a porous medium. adjacent to vertical or horizontal surface. The surface was heated and cooled sinusoidally along its length. Oothuizen and Patrick [2] investigated the natural convection heat transfer in an inclined square enclosure. The enclosure was differentially heated and partially filled with a porous medium. The study was focused on the average rate of heat transfer across the enclosure. Al-Amiri [3] investigated the momentum and energy transfer in a lid-driven cavity filled with a porous medium. He used the inertia and viscous effects through the general formulation of momentum and energy transfer. Yasin *et. al.* [4] studied the free convection in porous media filled right-angle triangular enclosure. The governing equations were obtained using Darcy model and solved by a finite difference techniques. Sharif [5] performed a numerical study on mixed convection heat transfer in an inclined lid-driven enclosure filled with viscous fluid. He selected a non-porous medium and observed that the mean Nusselt number increases as cavity inclination angle increases.A theoretical study of buoyancy-driven flow and heat transfer in an inclined trapezoidal enclosure filled with a fluid saturated porous medium was performed by Yasin et al.[6]. The governing equations were solved numerically by using a finite difference method. The study was performed for inclination trapezoidal angles ranged from 0° to 180° and Rayleigh number from 100

to 1000. Also the wall angles was ranged from 67° to 81°. The predicted results from that study indicated that the effect of trapezoidal inclination angle on heat transfer and flow strength was more than that of the side wall inclination angle. Kumar [7] investigated the free convection induced by a vertical wavy surface with heat flow in a porous enclosure. He verified that the surface temperature was very sensitive to the drifts in the undulations and amplitude. Abdalla et al. [8] analyzed the mixed convection heat transfer in a lid driven cavity with a sinusoidal wavy hot surface. The results of his study showed that the average Nusselt number is increased with an increase of amplitude of the wavy surface and Reynolds number. The effect of surface undulations on the free convection heat transfer from a horizontal wavy surface in a porous wavy enclosure was studied by Murthy et al. [9]. They assumed valid Darcy flow model. Their results showed that the waviness of the surface reduced the ratio of heat transfer compared with that of a flat surface.Dalal and Das [10] presented a numerical study for the natural convection in a cavity with a vertical wavy wall. Their results showed that the local rate of heat transfer and the flow field were significantly affected due to the undulation in the right wall. Hakan and Oztop [11] presented a numerical study to obtain the combined convection field in an inclined porous lid driven enclosure heated from one wall. The study was performed for $10 \leq Ra \leq 1000$, Darcy numbers $0.01 \leq 0.2$. It was reported that the flow field , temperature distribution and heat transfer rate are effected by the angle of inclination. Xu *et. al.* [12] performed a numerical study on unsteady natural convection in differentially heated cavity with a fin on a side wall. Different lengths for Ra 3.8×10^{9} were performed. The obtained results showed that the fin length significantly impacts on transient thermal flow around the fin and heat transfer through the finned side wall in the early stage of the transient flow development.In the present paper, the 2D natural convection inside an inclined wavy cavity has been numerically studied. As shown in Fig.1, the wavy vertical walls were obtained at different isothermal temperatures while the two horizontal walls were insulated. Different values of the amplitude, angle of inclination, undulation and Rayleigh number were examined. The grid generation system was obtained using procedure followed by Thomas et al .[13].

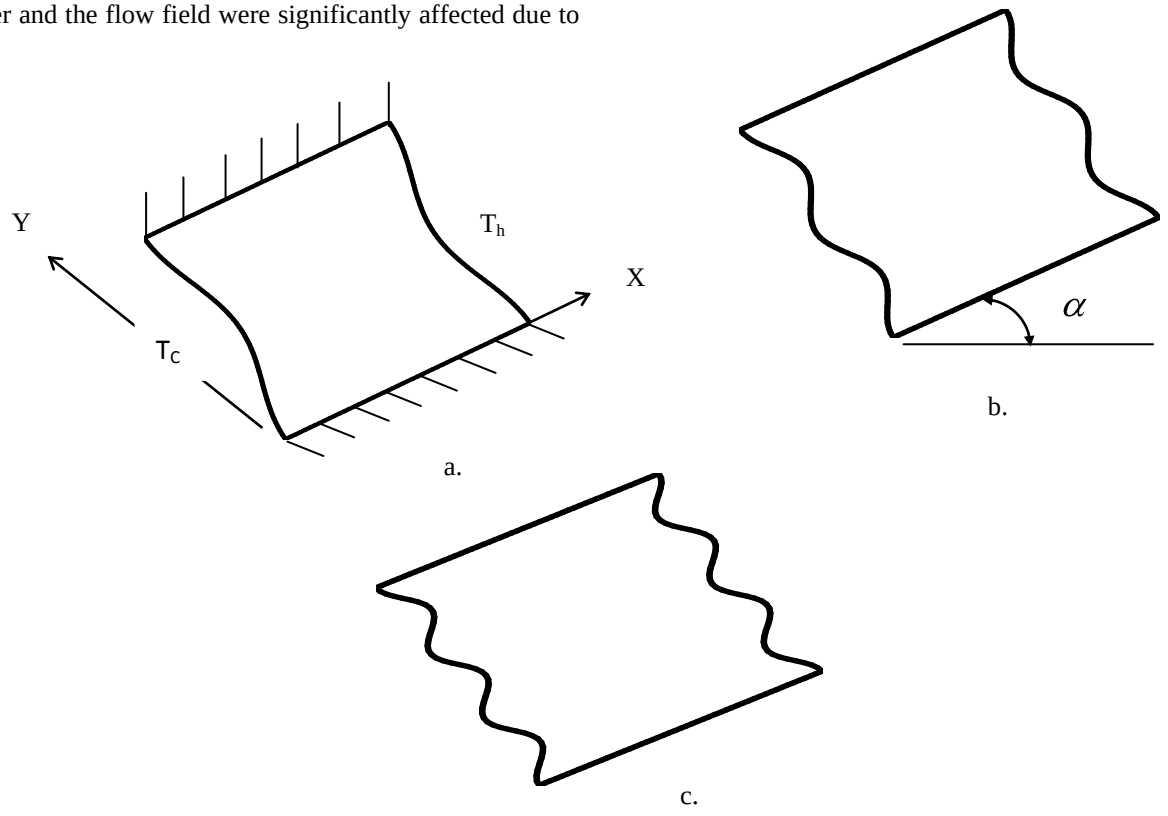

Fig.1.physical problem; a. one undulation, b. two undulation, c. three undulations

1-2 Grid generation

The numerical calculation of a flow field needs a suitable treatment of boundary conditions which are difficult to incorporate for complex boundary conditions. A grid generation technique is used to transfer a physical space in to a computational space. The grid generation method is used to map the non-rectangular grid in the physical space into a rectangular uniform grid in the computational space. The grid generation method proposed by Thompson [13] is used in the present study.The most common partial

differential equation used for grid generation in 2-D is an elliptic Poisson equation.

$$\zeta_{xx} + \zeta_{yy} = P(\zeta,\eta) \quad \text{--------- (1)}$$

$$\eta_{xx} + \eta_{yy} = Q(\zeta,\eta) \text{----------(2)}$$

where P and Q are known functions used to control interior grid clustering. All grids used in this work are generated with $P(\zeta,\eta) = Q(\zeta,\eta) = 0.$ The system is completed by addition of Drichlet boundary conditions which specify ζ and η as functions of x and y on the boundary of the region shown in Fig.1 . Calculations were performed on the rectangular region so that dependent and independent variables are interchanged to produce a system of two partial differential equations in the form of:

$$\alpha X_{\zeta\zeta} - 2\beta X_{\zeta\eta} + \gamma X_{\eta\eta} = -J^{-2}[X_{\zeta} P(\zeta,\eta) + X_{\eta} Q(\zeta,\eta)] \quad \textbf{(3)}$$

$$\alpha Y_{\zeta\zeta} - 2\beta Y_{\zeta\eta} + \gamma Y_{\eta\eta} = -J^{-2}[Y_{\zeta} P(\zeta,\eta) + Y_{\eta} Q(\zeta,\eta)] \quad \textbf{(4)}$$

Where

$$\alpha = X_{\eta}^{\,2} + Y_{\eta}^{\,2} \;,\; \gamma = X_{\zeta}^{\,2} + Y_{\zeta}^{\,2} \;,\; \beta = X_{\zeta} X_{\eta} + Y_{\zeta} Y_{\eta} \;,\; J = X_{\zeta} Y_{\eta} - X_{\eta} Y_{\zeta}$$

The discretization of equations (3-4) is obtained by using a second order central difference procedure and are solved by iteration method with SOR .

II. Mathematical Model

The laminar natural convection heat transfer in an inclined square wavy cavity filled with a porous media has been numerically studied. For adobting the related mathematical model, some assumptions were reported :

The properties of the fluid and the porous media are assumed to be constant

The viscous and inertia effects are ignored and the Boussinesque approximation is valid.

The governing differential equations of the mass continuity, momentum and energy are described as follows[14,15].

$$\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0 \text{----------(5)}$$

$$\frac{\partial u}{\partial y} - \frac{\partial v}{\partial x} = -\frac{g\beta K}{\upsilon}\frac{\partial T}{\partial x} \text{----------(6)}$$

$$\frac{\partial T}{\partial t} + u\frac{\partial T}{\partial x} + v\frac{\partial T}{\partial y} = a\left(\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2}\right) \text{----------(7)}$$

This is called Darcy model. The equations can be written in dimensionless form after using the following parameters.

$$u = \frac{\partial \psi}{\partial y},\; v = -\frac{\partial \psi}{\partial x},\; X = \frac{x}{H},\; Y = \frac{y}{H},\; \Psi = \frac{\psi}{a},\; \theta = \frac{T - T_c}{T_h - T_c},\; Ra = \frac{g\beta K(T_h - T_c)H}{a\upsilon},\; \tau = \frac{at}{H^2}$$

$$\frac{\partial^2 \Psi}{\partial X^2} + \frac{\partial^2 \Psi}{\partial Y^2} = -Ra\frac{\partial \theta}{\partial X} \text{----------(8)}$$

$$\frac{\partial \theta}{\partial \tau} + \frac{\partial \Psi}{\partial Y}\frac{\partial \theta}{\partial X} - \frac{\partial \Psi}{\partial X}\frac{\partial \theta}{\partial Y} = \nabla^2 \theta \text{----------(9)}$$

The transformation of the new dependent variables (ζ,η) defined in the preceding section leads to replacement of $\psi(x,y)$ in to $\psi(\zeta,\eta)$ and $\theta(x,y)$ to $\theta(\zeta,\eta)$[13].

$$\lambda\Psi_{\varsigma} + \sigma\Psi_{\eta} + \alpha\Psi_{\varsigma\varsigma} - 2\beta\Psi_{\varsigma\eta} + \gamma\Psi_{\eta\eta} = -JRa(\theta_{\varsigma} Y_{\eta} - \theta_{\eta} Y_{\zeta}) \text{----------(10)}$$

$$\theta_{\tau} + (-\Psi_{\zeta}\theta_{\eta} + \Psi_{\eta}\theta_{\zeta}) \Big/ J = (\lambda\theta_{\zeta} + \sigma\theta_{\eta} + \alpha\theta_{\zeta\zeta} - 2\beta\theta_{\zeta\eta} + \gamma\theta_{\eta\eta}) \Big/ J^2 \text{----(11)}$$

where

$$\lambda = \left(X_\eta D_y - Y_\eta D_x\right) \Big/ J \quad \text{---------- (12)}$$

$$\sigma = \left(Y_\zeta D_x - X_\zeta D_y\right) \Big/ J \quad \text{---------- (13)}$$

$$D_x = \alpha Y_{\zeta\zeta} - 2\beta Y_{\zeta\eta} + \gamma Y_{\eta\eta} \quad \text{----------(14)}$$

$$D_Y = \alpha X_{\zeta\zeta} - 2\beta X_{\zeta\eta} + \gamma X_{\eta\eta} \quad \text{----------(15)}$$

2-1 Boundary conditions

In order to solve the mathematical model, the following boundary conditions are used.

$U = V = 0$, $\theta = -0.5$, $\psi = 0$ on the cold wall

$U = V = 0$, $\theta = 0.5$, $\psi = 0$ on the hot wall

$U = V = 0$, $\dfrac{\partial\theta}{\partial X} = \left(\alpha\dfrac{\partial\theta}{\partial\varsigma} - \beta\dfrac{\partial\theta}{\partial\eta}\right) \Big/ J\sqrt{\alpha} = 0$,

$\psi = 0$ on the two insulated walls

The local and average Nusselt number along the hot wavy wall is calculated as follows.

$$Nu = -\int_0^1 \frac{d\theta}{dx}$$

$$Nu_{av} = \frac{1}{S}\int_0^s Nuds$$

where S is the total chord length of the wavy wall and s is the coordinate along the wavy surface. The shape of the right hot wavy wall is assumed to follow the formula $f(y) = [1 - Amp + Amp(\cos 2\pi ny)]$ and the left wavy wall is $f(y) = [1 - Amp(\cos 2\pi ny)]$ where Amp is the amplitude of the wavy wall and n is the number of undulations.

III. Numerical Solution

Finite difference technique has been used to discretize the mentioned partial differential equations. The resulting algebraic equations for temperature distribution, eq. 11were solved by using alternate difference implicit (ADI) method. The iteration method with successive overlaxation scheme (SOR) was used for solving the discretization equation of the stream function,eq.10. TheRelaxation factor used for stream function had the value of 1. A home computer program using Fortran 90 language was constructed to handle the considered problem. In order to ensure that the flow and heat transfer characteristics are not affected by the mesh, different grids were used, (31×31), (41×41) and (51×51) respectively. As shown in table1, there is not noticeable change between the used grids and the grid (51×51) is adopted in this work.

Table1. effect of mesh on Nu_{av} for Ra=500, A=1 and for one undulations

Mesh	Nu_{av}
31×31	4.49
41×41	4.41
51×51	4.39

IV. Results and Discussion

The computed results of the stream function, isotherm lines, local and average Nusselt numbers are presented as follow:

Fig.2 shows the distribution of stream function and isotherm lines for different angles of inclinations and one undulation. It can be seen that there is four counter rotating vortices when $\alpha = 0^0$. For $\alpha > 0^0$, the four resulting vortices are shrinking in to two elongated vortices. Also the position of these vortices is shifted compared with $\alpha = 0^0$. The thermal boundary layer thickness along the two wavy walls increases as angle of inclination increases. The effect of angle of inclination on isotherm lines is seen through (e-h) for $\alpha = 0^0$. The thermal boundary layer thickness along the crest is small and symmetrical about the cavity center. The transfer of heat from the hot wall to the cold wall is slow when $\alpha = 30^0$, the convection currents are increased where the isotherm lines pass through the crest and move away towards the cold one. The thermal boundary layer thickness along the wavy walls increases as the angle of inclination increases as shown in (g) and (h). The location of the hot wavy in (h) is expected to enhance the rate of heat transfer as shown in Fig8.a. The distribution of stream function and isotherm lines for different angles of inclination and three undulation is found in Fig.3. For $\alpha = 0^0$, eight counter rotating cells were formed. The size of cells near the upper and lower wall is larger compared

with the other cells. So, it can be concluded that the undulation of the two wavy walls has a significant effect on the flow field. The crest and tough of the wavy walls play an important role in obtaining this number of vortices. The increase of waviness of the wall is expected to enhance the rate of heat transfer. The effect of number of wavy walls undulations on the average rate of heat transfer for different Rayleigh numbers is found in Fig.6. It can be seen that the average rate of heat transfer is increased with the increase of rayleigh number and decreases with the increase of the wavy wall amplitude. However the local rate of heat transfer is increase with the increase of wavy walls undulations as shown in Fig.7. Fig.8 demonstrates the effect of angle of inclination on the local Nusselt number variation. It is evident that the local Nu increases as the angle of inclination increase for the studied parameters. The distribution of isotherm lines can be shown in (e-h). When $\alpha = 0^0$, the isotherms lines are symmetrical about the cavity center. When the angle of inclination is increased to $\alpha = 30^0$, the deviation of isotherm lines increases and that confirm increasing of convection currents and hence an increase of the rate of heat transfer. The behavior is increased with the increase of inclination angle. Also the thickness of the thermal boundary layer is increased with the increase of angle of inclination. The effect of Rayleigh number on stream function distribution is depicted in Fig.4. As the Figure shows, when Ra > 50, the resulting vortices become greater in size and elongated towards the wavy walls. As Ra increases, the buoyancy induced flow increases and that leads to increase of the rate of heat transfer as shown in Fig.5. The effect of the wavy walls amplitude (A) on stream function and isotherm contours is exhibited in Fig.9. As the figure shows, as A> 0.075 dramatic changes occurs fo both the stream function and isotherm lines distribution. The cause is expected to the effect of the crest and tough on convection currents. Also this is confirmed through Fig.11. The effect of angle of inclination(α) on the flow and thermal field for different values of amplitude is exhibited at Fig.10. it is clear that the angle of inclination has a significant effect on the distribution of stream function and isotherm lines. However this effect is clear at A>0.075 . when A=0.15, the elongation of the two vortices is very high toward the horizontal walls and the heat transfer from the hot wall to the cold one is faster because of decreasing of the distance between the two walls at the crest region. The effect of the wavy wall amplitude on the variation of Nusselt number for $\alpha = 30^0$ is demonstrated at Fig.11. It is evident that the local Nusselt number is increase as the amplitude increases. However this increase is larger for three undulation especially at A=0.15. The effect of angle of inclination on the average Nusselt number is depicted at Fig.12.Theaverage Nusselt number decreases as the amplitude increases. The validation of the present code is performed through a comparison with the available published results. As shown in Fig.13. The comparison indicated a good agreement.

V. Conclusions

The natural convection heat transfer and fluid flow inside an inclined wavy enclosure has been successfully simulated. The simulation process for the problem under consideration has been done for different angles of inclinations and Rayleigh numbers. So, the following concluding remarks can be obtained from the computed results.

The rate of heat transfer increases as the angle of inclination increases.

The maximum rate of heat transfer occurs at $\alpha = 90^0$.

The rate of heat transfer decreases as the wavy walls undulations increases.

The rate of heat transfer increases as the wavy wall amplitude increases.

The shape, number and distribution of the resulting vortices are significantly changed when $A \geq 0.15$.

The number of counter rotating vortices is significantly changed as the angle of inclination increases.

The elongation and the shape of resulting vortices are changed with the increase of angle of inclination.

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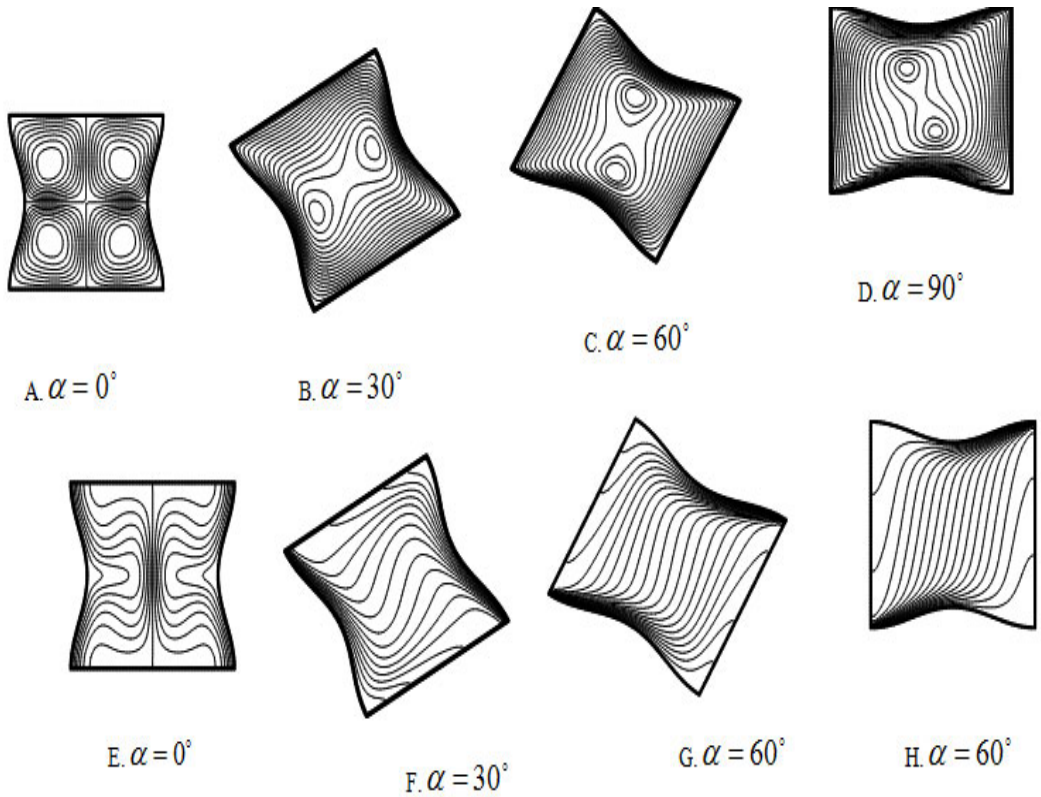


Fig.2 stream function and isotherm distribution for different angles of inclination, one undulation and Ra=500

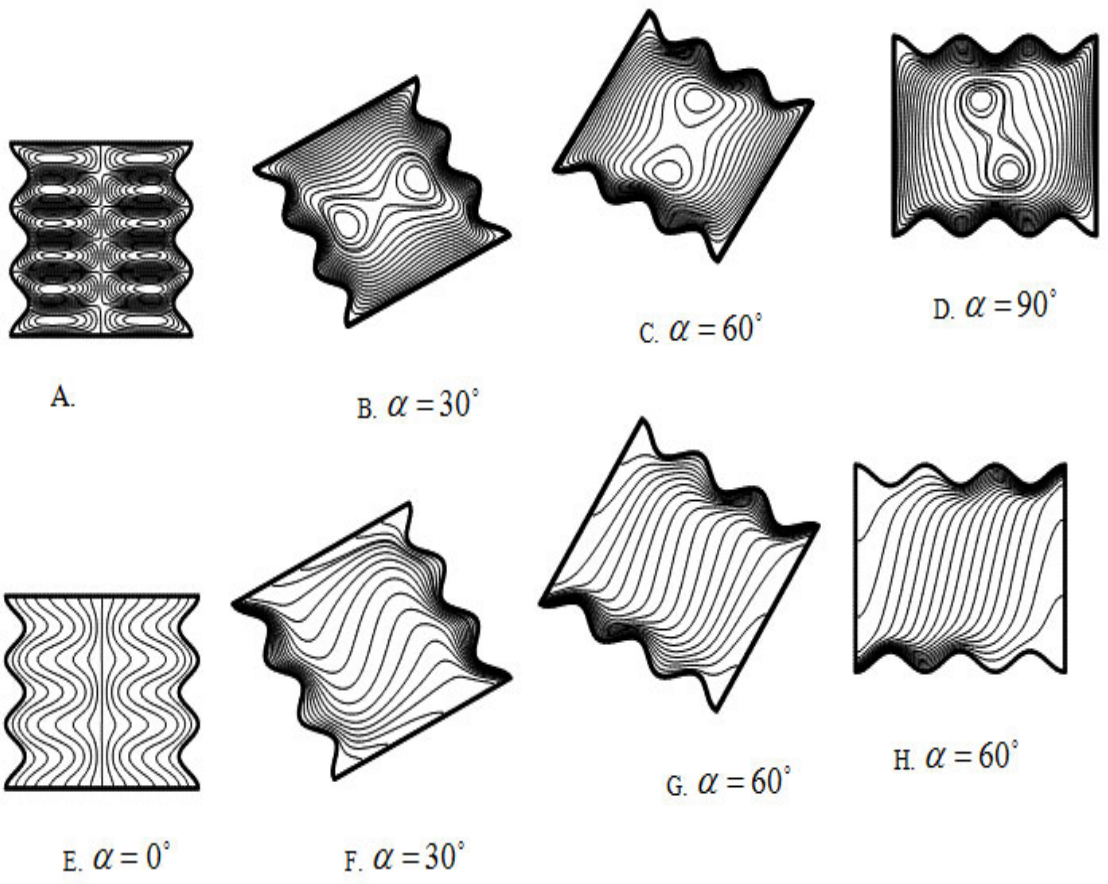
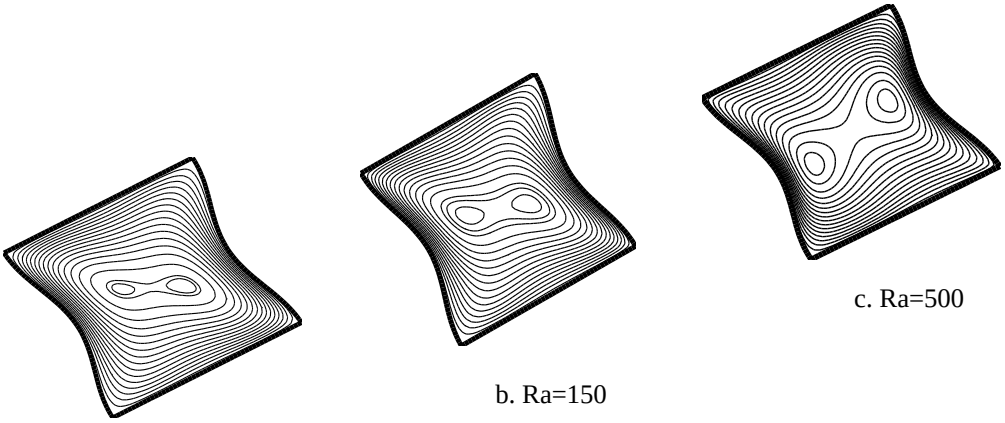


Fig.3 stream function and isotherm lines distribution for different angles of inclination, three undulation and Ra=500



a. Ra=50 b. Ra=150 c. Ra=500

Fig.4 effect of Ra on stream function distribution for one undulation and A=0.05

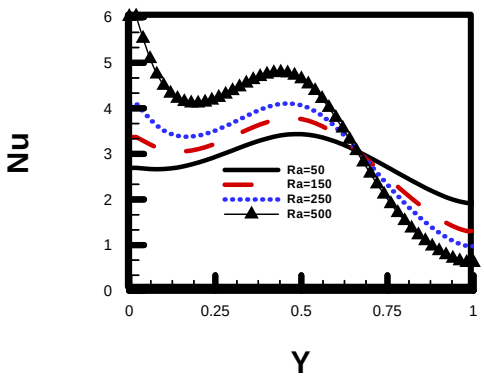


Fig.5 effect of Rayleigh number on local Nusselt number(at the hot wall) for A=0.05, $\alpha = 30^{\circ}$

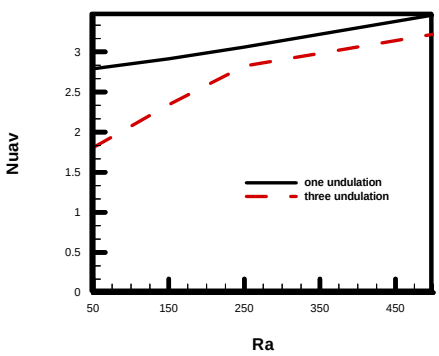


Fig.6 effect of Rayleigh number on average heat transfer rate(at the hot wall) for A=0.05, $\alpha = 30^{\circ}$

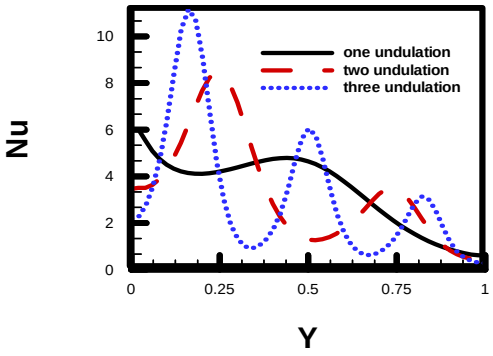
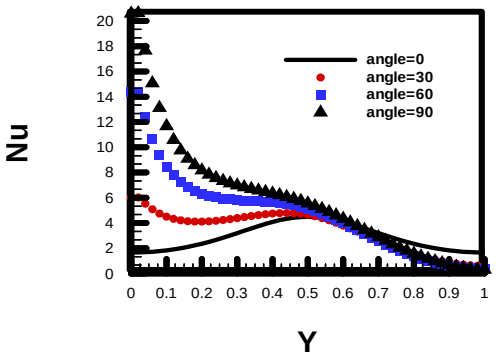
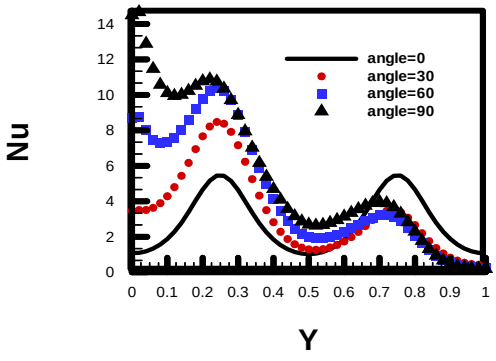


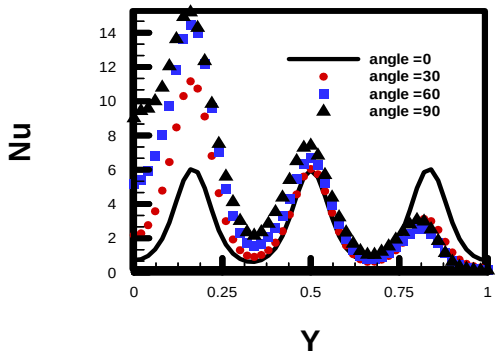
Fig.7 variation of local Nusselt number on the hot wall for different undulations at A=0.05, $\alpha = 30^{\circ}$,Ra=500



a. one undulation



b. two undulation



c. three

Fig.8 effect of angle of inclination on Nu distribution(at the hot wall) for A=0.05 and Ra=500

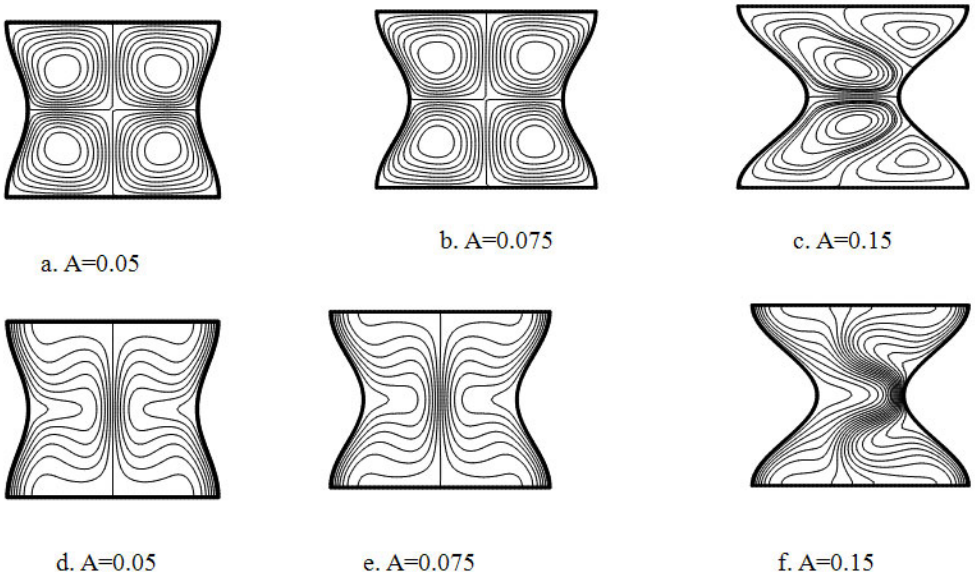


Fig.9 effect of wavy walls amplitude on stream function and isotherm lines distribution for one undulation, Ra =500 and $\alpha = 0^{\circ}$

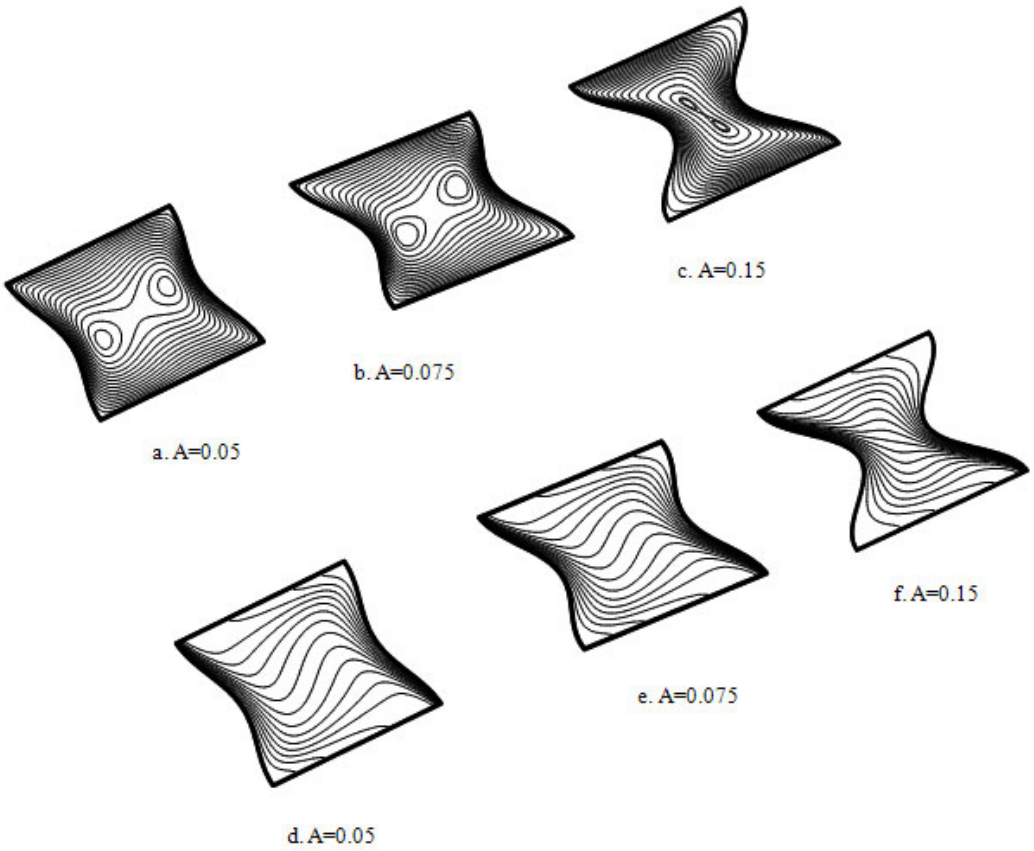
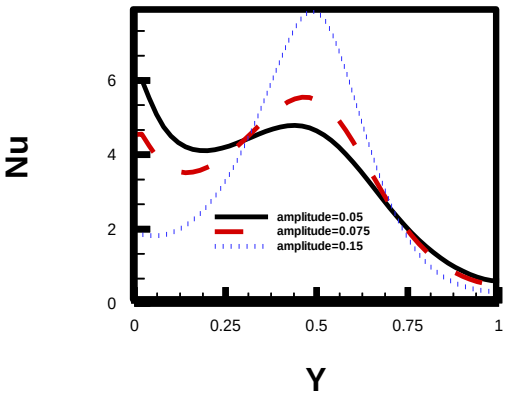
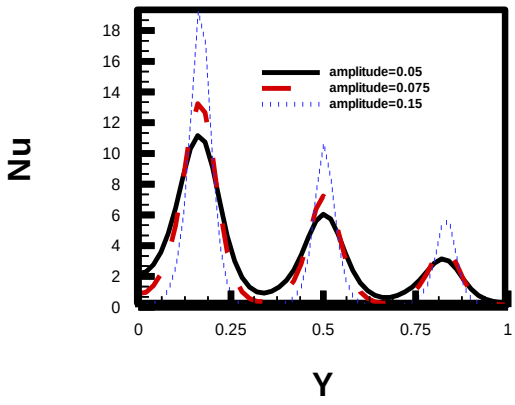


Fig.10 effect of wavy wall s amplitude on stream function and isotherm lines distribution for one undulation, Ra =500 and $\alpha = 30^{\circ}$



a. one undulation



b. three undulation

Fig.11 effect of a hot wavy amplitude on variation of Nu for one undulation and Ra=500, $\alpha = 30^{\circ}$

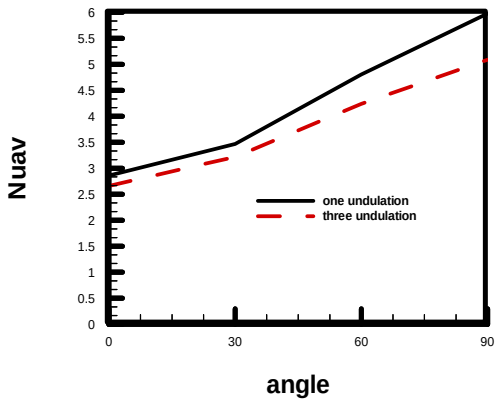
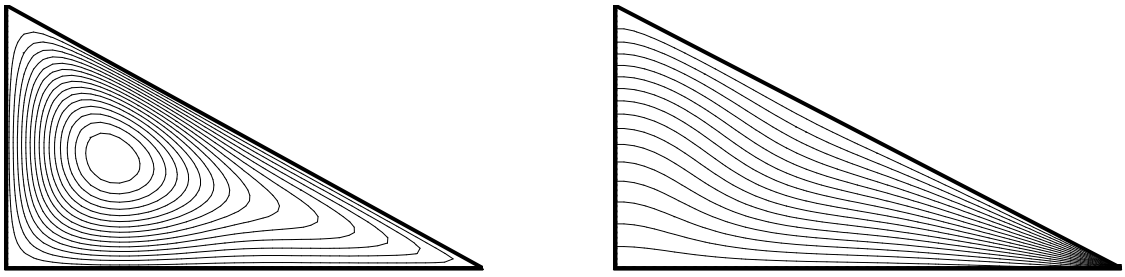
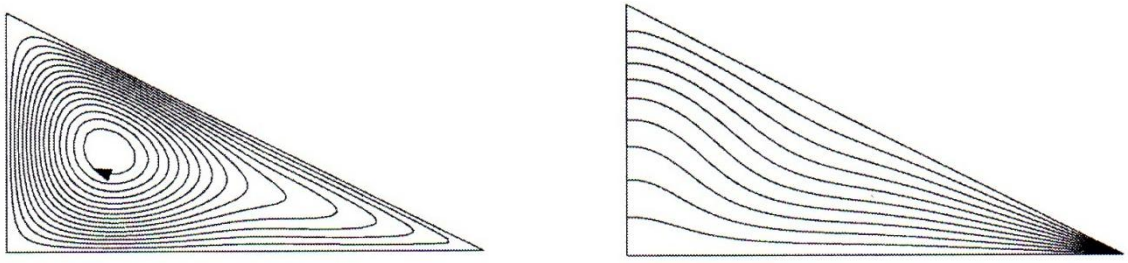


Fig.12 variation of mean Nusselt number versus angle of inclination at Ra=500



a. present results of stream function b. present results of isotherm contours



c .published results of stream function d .published results of isotherm contours

Fig .13 validation of the present code with published results [4]
at Ra = 50 and $\alpha = 0^{\circ}$

Use of Onboard Sound Card for Triaxial Monostatic Doppler SODAR Operation with MATLAB Tools

GJRE Classification (FOR) 090609, 280204

A.Nagaraju[1], A.Kamalakumari[2], A.B.Rao[3], M.P.Rao[4]

Abstract: **The use of onboard sound card features of general purpose multimedia PC to generate tone bursts 1750, 2000 and 2250 Hz signals for tri-axial monostatic Doppler sodar system along with the timing signals for both transmission and reception. In this paper we describe the use of Data acquisition tool box (DAT) and Signal processing tool box (DSP) in connection with the onboard sound card of PC for transmission, reception and processing of back scattered echo signals. Data acquisition tool box (DAT) of MATLAB provides set of functions analog output(AO), analog input(AI)objects to produce and acquire a sound. Signal processing tool box (DSP) of MATLAB functions like fft, max are used for Processing of the acquired data.**

I. INTRODUCTION

SODAR systems are used to remotely measure the vertical turbulence structure and the wind profile of the lower layer of the atmosphere. Sodar systems are like radar (*radio detection and ranging*) systems except that sound waves rather than radio waves are used for detection. Other names used for sodar systems include sounder, echo sounder and acoustic radar(Stuart Bradley, 2007). A more familiar related term may be *sonar*, which stands for *sound navigation ranging*. Sonar systems detect the presence and location of objects submerged in water (e.g., submarines) by means of sonic waves reflected back to the source. Sodar systems are similar except the medium is air instead of water and reflection is due to the scattering of sound by atmospheric turbulence.Most sodar systems operate by issuing an acoustic pulse and then listen for the return signal for a short period of time. Generally, both the intensity and the Doppler (frequency) shift of the return signal are analyzed to determine the wind speed, wind direction and turbulent character of the atmosphere. A profile of the atmosphere as a function of height can be obtained by analyzing the return signal at a series of times following the transmission of each pulse. The return signal recorded at any particular delay time provides atmospheric data for a height that can be calculated based on the speed of sound. Sodar systems typically have maximum ranges varying from a few hundred meters up to several hundred meters or higher. Maximum range is typically achieved at locations that have low ambient noise and moderate to high relative humidity. At desert locations, sodar systems tend to have reduced altitude performance because sound attenuates more rapidly in dry air.

Sodar systems can be used in any application where the winds aloft or the atmospheric stability must be determined, particularly in cases where time and cost are of the essence. Some typical applications include: atmospheric dispersion studies, wind energy, wind shear warning, emergency response wind monitoring, sound transmission analyses, microwave communications assessments and aircraft vortex monitoring. Some of the advantages of sodar systems are obvious compared to erecting tall towers with in-situ wind and temperature sensors. First, a sodar system can generally be installed in a small fraction of the time it takes to erect a tall tower. And when all of the costs are considered, a sodar system will generally offer a very attractive alternative. Also, the practical height limit for meteorological towers is about 150 m (500 ft). Most sodar systems will obtain reliable data well beyond this altitude. Using a sodar system instead of a tall tower will also avoid many liability issues. Sodar systems do have some drawbacks compared to tall towers fitted with in-situ wind sensors. Perhaps the most significant is the fact that sodar systems generally do not report valid data during periods of heavy precipitation. Another consideration is that sodar systems primarily provide measurements of mean wind. Other wind parameters, such as wind speed standard deviation, wind direction standard deviation and wind gust, are usually either not available or not reliable. This is because to obtain a wind measurement sodar systems sample over a volume and at multiple points in space and time, whereas an in-situ wind sensor on a tall tower samples instantaneously at a point in space and time.

II. METHODOLOGY

The block diagram of the developed tri axial Doppler sodar system is shown in Figure 1. The system is designed for three frequency operation that is rather widely spaced. The system is planned for operation in pulsed mode and is expected to provide profile measurements up to about 600 m height from the ground. The operating frequencies of sound are 1750Hz, 2000Hzand 2250Hz respectively. The acoustic pulse length varies from 100 ms to 500 ms with power outputs ranging between 200 W and 300 W. Using MATLAB in conjunction with the on-board soundcard of the Personal Computer (PC), a 100ms duration pulse called 'tone-burst' is generated continuously at the operating frequency of 2 kHz. In between every two transmitting pulses the reception of the reflected pulse from the

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atmosphere is done for a period of 3800ms. The received pulse is processed to obtain its frequency spectrum and also it is expected to obtain its intensity profile as a function of real-time.

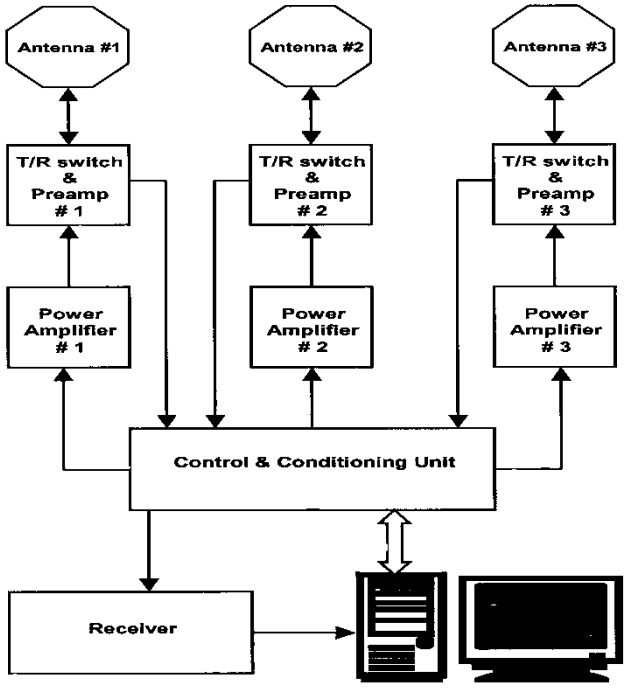


Figure 1: Block Diagram of tri-axial monostatic Doppler sodar

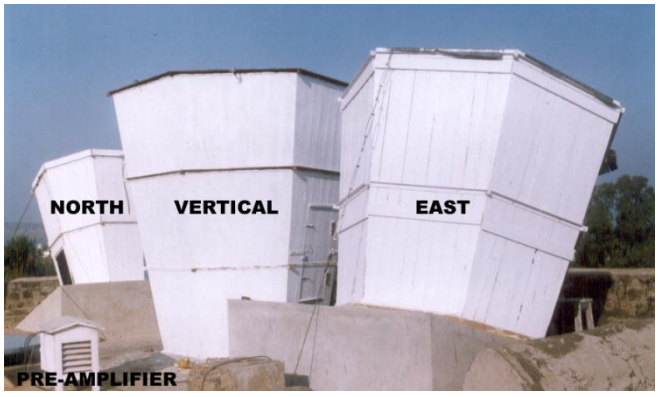


Figure 2: Antenna configuration for tri-axial monostatic Doppler sodar

A personal Computer (PC) is the heart of the sodar system. The PC generates all the timing signals and the three transmitting frequencies. The control and conditioning unit consists digital and analog circuitry to drive the power amplifiers with necessary pulse shaping and timing. The three T/R switch and pre-amp units pass the output of the power amplifiers to the three antennae shown in fig 2, and receive the echo signals after a preset of time lapse. The three antennae configuration is necessary because of the spacing between the three transmitting frequencies. The antennae shall be designed to provide 3-dB beam widths of about 10°.The echo- signals received from the antennae are passed through the control unit where the three signals are added. The receiver provides further amplification and filtering. The on-board resources of the PC are used for ADC and other digital signal processing implementation.

III. EXPERIMENTAL SET-UP

Transmitter: Analog output subsystems and Data Acquisition Toolbox (DAT) are used for generating a sound pulse from the sound card. The sine wave data with a transmitting 'ON' time of 100ms is generated in MATLAB, outputted to the D/A converter on the soundcard and sent to speaker-out terminal. The 'speaker out' terminal is then connected to the external hardware i.e. to the power amplifier from which the amplified signal is sent to the atmosphere through parabolic dish antenna. The set-up is shown in Fig 4.

Figure 3: PC and control electronics in sodar laboratory

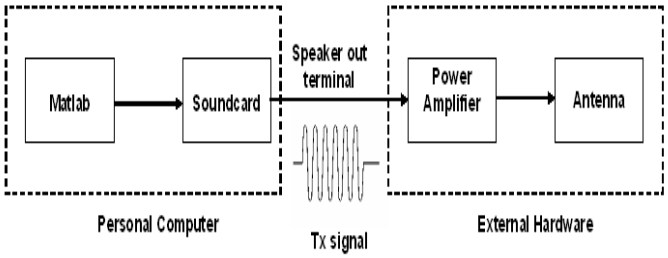


Figure 4: Set-up for Transmitter

The first step in configuring the data acquisition session is to create the device object for outputting the data. The device object is 'analog output' (Mehrl and Hagley,1998; Hagley and Mehrl,2001)configured to soundcard through the module 'winsound' which provides access to the basic sound-playing machinery provided by Windows platforms. Following is the syntax:ao analogoutput('winsound') addchannel(ao,1)The function'addchannel' adds hardware channels to the object. 1 represents outputting data in mono mode whereas if are given then the data is outputted in stereo mode. The next basic step includes configuring property values to outputting data. These include duration or ON time (t) of the sine wave which is set to 0.1 seconds,

amplitude (Amp) to 1V, frequency(freq)of the sine wave to 2000 Hz and sample rate(Fs) to 8000 Hz. After the values are assigned to the basic set-up properties, the sine wave is defined by,

y = Amp*sin(t*2*pi*freq).

Before data can be sent to the analog output hardware, you must queue it in the engine. The function 'putdata' queues the data specified by data in the data acquisition engine for eventual output to the analog output subsystem. putdata(ao,[y']); y' represents one column of data queued for channel 1 in mono mode contained by the analog output object. The data acquisition engine is a MEX-file dynamic link library (DLL) file that stores the device objects and associated property values that control your data acquisition application, controls the synchronization of events and storage of acquired or queued data.While the engine performs these tasks, you can use MATLAB for other tasks such as analyzing acquired data. An event called 'Trigger' is set to 'immediate' to log data into memory immediately after the 'start' command is given. In order to transmit continuously the function 'Trigger Repeat' is configured to 'infinite' using the function 'set'. The command 'start (ao)' outputs the data to the speaker. Receiver:After the transmission of pulse is done and another delay of 100 ms, the reception of the reflected signal is done for the next 3800 ms. The antenna used for transmission purpose is also used for reception of reflected sound in duplex mode. Signal from the antenna is fed to the 'line-in' terminal of the sound card through a pre-amplifier as shown in Fig 5.

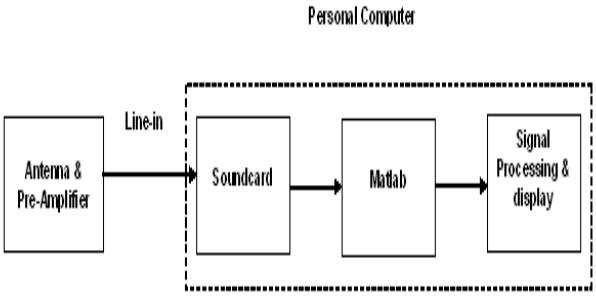


Figure 5: Set-up for Receiver

Immediately after the acoustic pulse is generated a delay of 100ms (0.1sec) is given using the command

pause(0.1);Now, the program for acquisition of reflected data is coded very next to transmission code. Acquiring the data using DAQ is almost similar to outputting data except the device object created is 'analog input' (Mehrl and Hagley,1998; Hagley and Mehrl,2001) instead of analog output. Following is the syntax:

AI = analoginput('winsoun addchannel(ao,1)The signal is acquired in mono mode by adding the channel 1 to AI. The properties to be configured are analogous to analog input properties except the duration for acquiring is set to 3.8 seconds. During execution, instead of 'putdata' function in analog output, 'getdata' function is used to extract data, time, and event information of acquired samples from the data acquisition engine. After the 'start' command is given data is retrieved by,

[data] = getdata(AI);

The acquisition ends once all the data is acquired. To end the acquisition session, we can delete the AI object from the workspace using the funcdelete (AI);

IV. PROCESSING OF THE ACQUIRED DATA

In order to represent the samples in frequency domain, Fast Fourier Transform is applied tothe acquired data samples using the function,

d = fft(data);

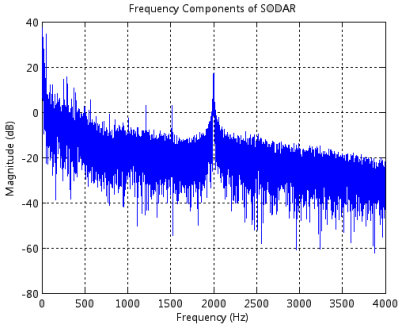
xfft = abs(d);

xfft gives the absolute value of fft.The absolute value is convertedinto dB magnitude and extracts the real frequency components using the function,

mag = 20*log10(xfft)mag = mag(1:floor(blocksize/2));

Blocksize represents the maximum number of points allowed in a block given by the product of duration of receiving signal and its sample rate.Now, the magnitude (mag) is plotted in a linear 2-D manner, as a function of frequency (f) using the 'plot' function as shown in the Fig.5.

plot(f,mag);



. **Figure 5: Photograph of frequency spectrum**

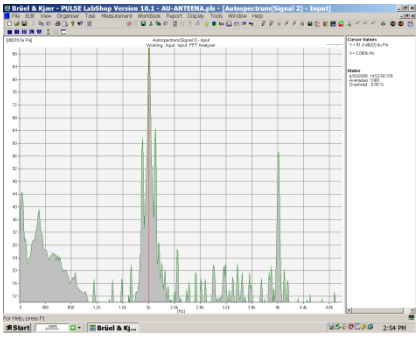


Figure 6: Photograph of frequency spectrum of received signal

V. CONCLUSIONS AND FUTURE WORK

MATLAB code for transmitting three varying frequencies outputted from the sound card is developed. The spectrum of the echo-signal contains the Doppler shift and noise. Noise can be eliminated using Filter Design toolbox of Matlab. Further processing methods involve display of echo-signal intensity plot and calculation of wind profile by

estimating the Doppler-shift on each tone burst signal.For long range detection the energy has to be high which means longer pulses, and for high resolution the subpulse width has to be very small. Then the use of pulse compression with small subpulse width can be implemented. Consequently another main achievement inhigh sensitivity and fine range resolution.

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Current Financial Schemes of Solar Home System Projects in Bangladesh and Users' Opinion

Dr. Tsutomu Dei[1], Asif Islam[2], Alimul Haq Khan[3]

GJRE Classification (FOR) 660206

Abstract **- In this study, a baseline survey was carried out to clarify current situation of renewable energy in Bangladesh. All the information has been collected by inventory survey for 120 Solar Home System (SHS) users and private sectors including NGOs which are working on PV or Biogas. 14 villages of 6 districts (Pabna, Natore, Bogra, Sirajgonj, Barisal& Jhalkathi) have been covered through-out the whole study. Financial support of this survey has been provided by Nippon Koei, Japan & JICA (Japan International Co-operation Agency) provided all kinds of technical support. The study represents a real time reflection of the general people opinion on the payment scheme of PV systems provided to them.**

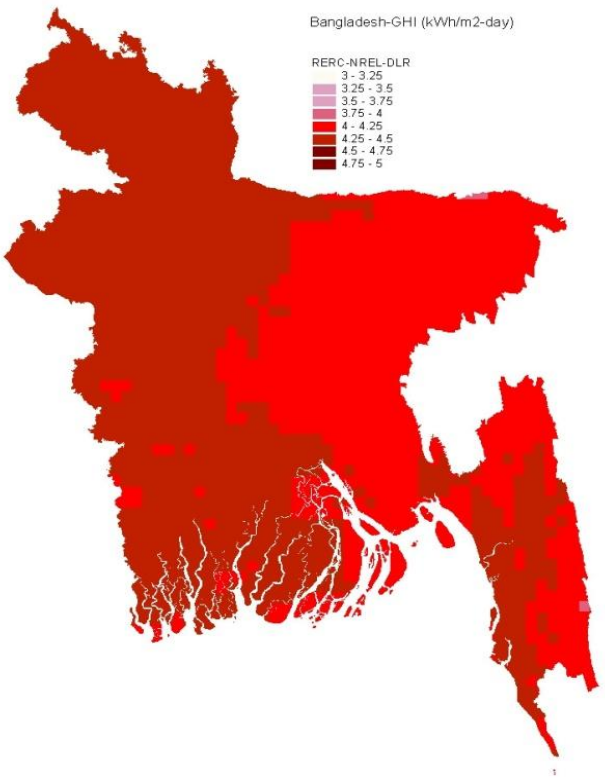
Keywords-Rural Electrification Board (REB), Solar Home System (SHS),Grameen Shakti (GS), Non-Government Organization (NGO), Infrastructure Development Company Limited (IDCOL), Japan International Co-operation Agency (JICA), Fee for Servive, Micro-Credit

I. INTRODUCTION

Greatest amount of solar energy is available in two broad bands [1] encircling the earth between 15° and 35° latitude north and south. The next best position is the equatorial belt between 15° N and 15° S latitude. Most of the developing countries, being situated [2] in these regions, are in a favorable position in respect of solar energy. Bangladesh is situated between 20.34° and 26.38° latitude north [3] and as such has a good solar energy potential.The location is suitable for use of solar energy for power generation. Average daily solar irradiation [4] at flat surface is around 4.0 to 6.5 kWh/m^2 in Bangladesh. Monthly average of solar irradiation is highest at March and April and lowest at December and January. Figure-1shows solar irradiation map [5] which has been prepared by SWERA (Solar and Wind Energy Resource Assessment) project financed by UNEP / GEF.

II. BACKGROUND

In 1988, Bangladesh Atomic Energy Commission (BAEC) installed several pilot PV systems. The first significant PV-based rural electrification program was financially supported by France. Three Battery Charging Stations (BCS) with a total capacity of 29.4 kWp and a number of standalone solar home systems (SHS) with a total capacity of 32.5 kWp were installed. Rural Electrification Board(REB) owned the systems and the users paid a monthly fee for the services. REB has installed around 13,000 SHSs under UNDP/GEF project which was implemented during 2002 to 2008. Since 1996, SHSs have been disseminating rapidly, due to the efforts of mainly Grameen Shakti (GS), which sells PV systems on micro credit to rural households through its extensive network. PV modules are imported while there are private companies which manufacturing PV accessories. As indigenous industry, local manufactures of PV components are well established.



III. PRESENT SCENARIO

Infrastructure Development Company Limited (IDCOL) is a semi-governmental organization which was established in May 1997 [6] by the Government of Bangladesh. The company was licensed by Bangladesh Bank as a non-bank financial institution in January 1998. Under IDCOL's project, largest number of SHS are installed in Bangladesh. IDCOL plans to install 1,000,000 SHS [7] at rural households by 2012. IDCOL has installed around 284,000 of SHSs until March2009. Table-1 indicates division-wise installation of SHS by Participating Organizations of IDCOL.

About[1,2&3]-[1]Nippon Koei Co. Ltd.[2]Energypac Engineering Ltd.[3]Bangladesh University of Engineering & Technology (BUET)
Email: asif038@gmail.comalimul_buet@yahoo.com

Division	Number of SHSs Installed
Barisal	40,251
Chittagong	59,496
Dhaka	62,756
Khulna	46,664
Rajshahi	40,293
Sylhet	34,012
Total	**284,102**

Table 1: Division-wise installation of SHS by POs of IDCOL (March, 2009

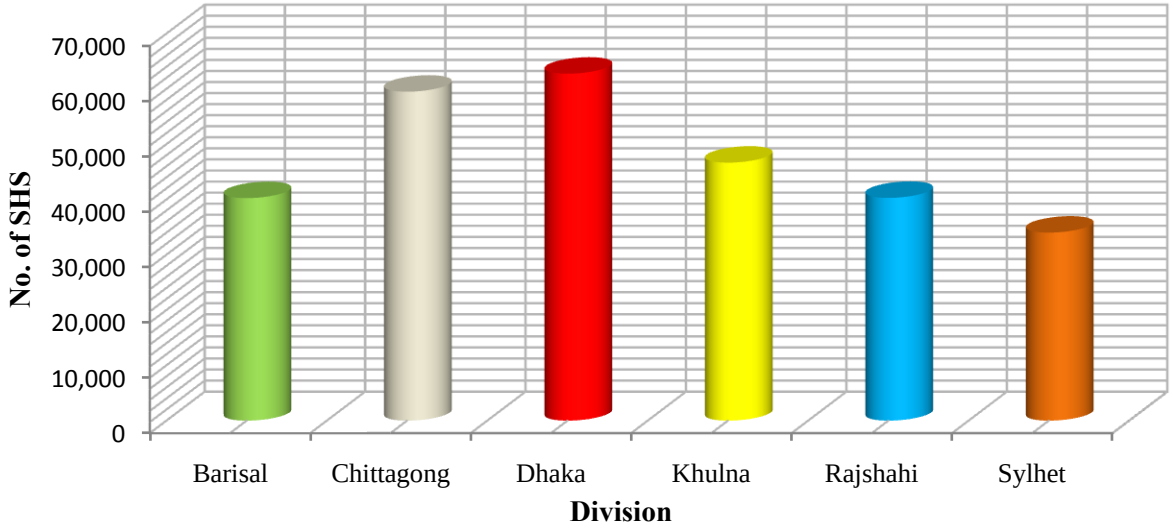


Fig. 2. Division-wise distribution of SHS installed by IDCOL

IV. Financial Models

There are two types of payment schemes for using SHS. First model is known as Fee for Service and this project is being carried on by Rural Electrification Board (REB). The other scheme is known as Micro-Credit System [8] which is handled totally by NGOs. Grameen Shakti (GS) is the most leading NGO which was initiated in 1996 by the co-builder of Grameen Bank. More than 220,000 of SHS have been installed by GS at the end of March in 2009.

V. Micro-Credit System

Several types of SHSs package and credit schemes are available in GS projects. Table-2 shows price list of SHS packages in GS project. Therefore, it is easier for customer to select appropriate SHS based on their income level and demand of electricity. The capacity of the smallest system is 10 Wp and the load is a 5 W lamp with two LEDs. The capacity of the largest system is 130Wp and the load is 11numbers of 6W lamp and one black and white TV with 17 to 20"Under GS projects, SHS have been installed around in 40,000 villages and it covers all of 64 districts in the country. There are three payment schemes as shown in table-3.Most common system for users is 50Wp system and the load is 4 of 6W lamp and one of black and white TV.

VI. Fee for Service

Around 13,000 SHSs which have been installed by REB follow this Fee for Service scheme. In this service, the PV system remains under the ownership of REB and customers have to pay monthly bill to REB. Though the initial cost of membership is same for all packages but monthly bill varies according to system capacity. REB provides four different packages to the customers and their monthly billing information has been visualized in Table-4.

	Capacity (Wp)	Load	Instruments	Cost (1USD=Tk.68)
1	130	6W lamp x 11, 17"-20" B/W TV	Battery: 100Ah×2 Charge controller: 15A Others: switch, cable, installation etc.	Tk. 68,000 (USD 1000)
2	120	6W lamp x 10, 17"-20" B/W TV	Battery: 100Ah×2 Charge controller: 15A Others: switch, cable, installation etc.	Tk. 65,000 (USD 956)
3	85	6W lamp x 7, 17" B/W TV	Battery: 130Ah Charge controller: 10A Others: switch, cable, installation etc.	Tk. 42,500 (USD 625)
4	65	6W lamp x 5, B/W TV	Battery: 100Ah Charge controller: 5 or 10A Others: switch, cable, installation etc.	Tk. 34,000 (USD 500)
5	50	6W lamp x 4, B/W TV	Battery: 80Ah Charge controller: 5 or 10A Others: switch, cable, installation etc.	Tk. 28,000 (USD 412)
6	40	6W lamp x 3, B/W TV	Battery: 55Ah Charge controller: 5 or 10A Others: switch, cable, installation etc.	Tk. 22,500 (USD 331)
7	20	7W CFL lamp x1, LED x3	Battery: 23Ah Charge controller Others: switch, cable, installation etc.	Tk. 13,500 (USD 199)
8	10	5W lamp x1, LED x2	Battery: 18Ah Charge controller Others: switch, cable, installation etc.	Tk. 9,500 (USD 140)

Table-2 : Price list of SHS packages in GS project

Fig.-3 : SHS at a shop in rural area

Mode of Repayment	Down Payment	Installment	Service Charge (Flat rate)
Option-1	25%	24 Month	4%
Option-2	15%	36 Month	6%
Option-3	100% Cash payment with 4% discount		

Table-3 : Payment scheme

	Capacity (Wp)	Membership Cost (BDT)	Bill per Month (BDT)
1	**40**	20	**180**
2	**50**		**205**
3	**80**		**306**
4	**100**		**392**

Table-4 : Fee for Service Billing Schemes

PUBLIC ATTITUDE

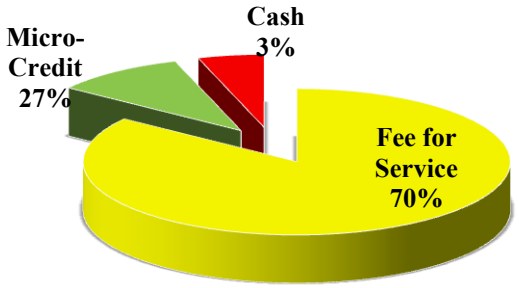


Fig-4 :First half reaction

The field survey [9] has been done through three different tours. The first tour was covered on Sirajgonj and Pabna district whereas the second tour was carried through Natore and Bogra. During these two tours, 60 household data has been collected who use SHS. Among them, 16 liked to choose the Micro-Credit system, 42 casted their vote on Fee for Service scheme and the residual 2 put the tick mark on Direct Cash payment. At last tour, data has been collected from Barisal and Jhalkathi. Again 60 household data has been accumulated among which 51 families picked up Micro-Credit system, 5 went for Fee for service and 4 chose Direct Cash payment package. To cover first two survey, REB provided the additional man-power and GS managed local support for the last visit.

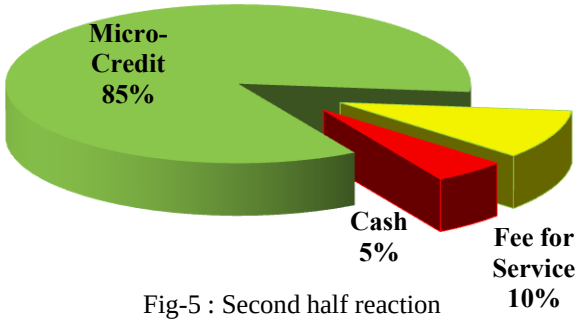


Fig-5 : Second half reaction

VII. CONCLUSION

All the financial models ongoing for SHS expansion projects are represented thoroughly in this study. Attitude of general people for billing schemes is also surveyed. From the data analysis, public reaction can be explained in such a way that in the districs of Rajshahi Division (Natore, Bogra, Sirajgong & Pabna), Fee for service scheme is more popular than Micro-Credit system. This is because in Fee for service, the PV system remains at the ownership of government. The national grid is going to expand in those districts and when grid current will be available to users then the SHS will become a burden to them. So they are not willing for permanent ownership through Micro-Credit system. In case of villages at Barisal division, Micro-Credit system is more popular because their land is separated from main-land by a lot of rivers. There is a less or no chance for national grid expansion in near future at that region. As a result, inhabitants of that region are not interested in continuous billing process through Fee for Service system. Rather they want the ownership of the SHS by Micro-Credit installment system.

VIII. ACKNOWLEDGEMENT

The authors would like to acknowledge JICA (Japan International Co-operation Agency) for their technical & manpower management and Nippon Koei Co. Ltd. for their full financial support. They are also grateful to Rural Electrification Board (REB) and Grameen Shakti for their cordial local co-operation.

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Video Data Mining Advances in Media and Entertainment World for Efficient Indexing and Retrieval

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***Abstract*-To achieve more efficient video indexing, its semantic content and access, I introduce avideo database management framework and strategies for video content structure and eventsmining. The video shot segmentation and key-frame selection strategy are first utilized to parsethe continuous video stream into physical units. Video shot grouping, group merging, and sceneclustering schemes are then proposed to organize the video shots into a hierarchical structureusing clustered scenes, scenes, groups, and shots, in increasing granularity from top to bottom.Then, audio and video processing techniques are integrated to mine event information, such asdialog, live performance and summary, from the detected scenes. Finally, the acquired videocontent structure and events are integrated to construct a scalable video skimming tool which canbe used to visualize the video content hierarchy and event information for efficient access.Experimental results are also presented to evaluate the performance of the proposed frameworkand algorithms.**

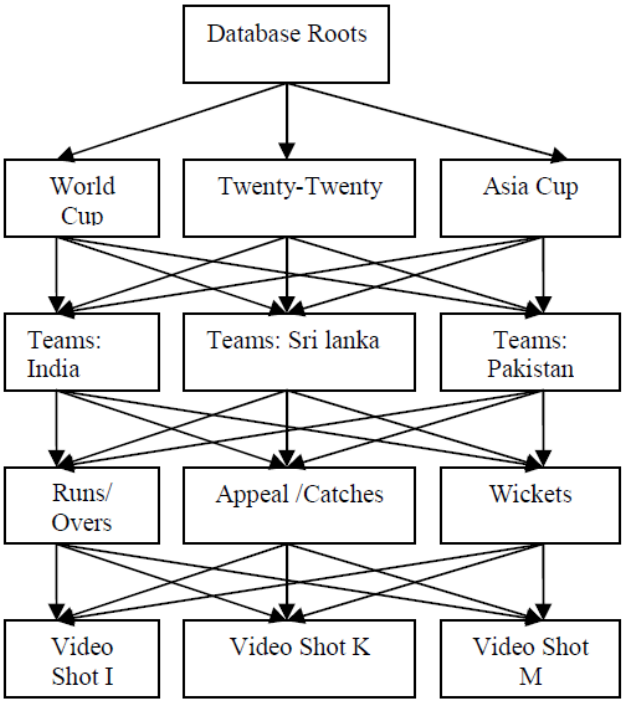
Index Terms-Video processing and mining, multimedia systems, database system, and knowledge-based systems.

I. INTRODUCTION

In this chapter I focus on the shot-basedapproach. There are two widely acceptedapproaches for accessing video in databases:**shot-based** and **object-based**. Incomparison with traditional video databasesystems that use low-level similaritiesamong shots to construct indices, a semanticvideo database management framework has been proposed.First, as background, a simpleframework is proposed for the videos topartition them into a group of different shotsto distinguish them in a hierarchical way.

1. Database level
2. Cluster
3. Sub-Cluster
4. Events
5. Shot & Frame

Second, the characteristics of the coded multimedia data that facilitate integration in a common coded database are explained. In addition, the merits of a common coded database in terms of storage, retrieval, presentation and use when compared with multimedia databases are highlighted. Third, the types of data included in the video association algorithm and an association-based video event detection scheme are explained. I use Cricket videos as this test bed because sports video generates large interest and high impact worldwide. I solve the first and third problems by deriving knowledge from domain experts (or from extensive observations) and from the video concept hierarchy. For Cricket videos, I first classify them into a two-level hierarchy. The first level is the host association of the games, e.g., World cup, Twenty-Twenty and Asia cup, and the second level consists of teams of the association, such as India, Sri lanka and Pakistan, where each video can be explicitly classified into one node. Then, I integrate the structure of video content to construct lowerlevel indices. As I have stated above, extensive observations and existing research efforts suggest that there are many interesting events in sports videos that can be used as highlights



.Figure 1 - The concept hierarchy of video content in the Cricket ground, where the sub cluster may consist of several levels.

These efforts are motivated by successful data mining algorithms and by the tremendous appeal of efficient video database management. Consequently, many video mining approaches have been proposed, which can be roughly classified into three categories:

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1) Special pattern detection, which detects special patterns that have been modeled in processing and data mining algorithms are seamlessly integrated to explore video content.

(a) (b) (c) (d)

Figure 2 - Examples of the shots related from six's of "batsman," where shot (b) is captured right after shot (a).

First utilize a general shot segmentation and key-frame selection scheme to parse the video stream into physical units. Then, the video group detection, scene detection and clustering strategies are executed to mine the video content structure. Various visual and audio feature processing techniques are utilized to detect slides, face and speaker changes, etc.Within the video, and these results are joined together to mine three types of events (presentation, dialog, clinical operation) from the detected video scenes. Finally, a scalable video skimming tool based on the mined video content structure and event information is constructed to help the user visualize and access video content more effectively.

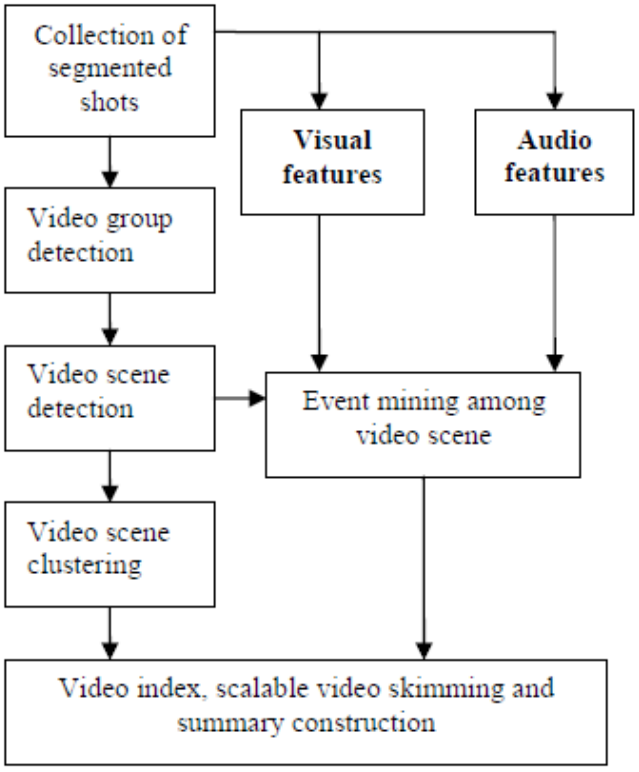

Figure 3-Video mining and scalable videoskimming/summarization structure.

II. A KNOWLEDGE BASED SPORTMANAGEMENT SYSTEM

A video management framework is make to support effective video access. The inherent hierarchical video classification and indexing structure can support a wide range of granularity levels. The organization of visual summaries is also inherently supported. Hence, a naive user can browse only a portion of highlights (events) to get a concise summary. By integrating the video knowledge in the indexing structure, the constructed video database system will make more sense in supporting the retrieval and browsing for naive users. As shown in Fig. 3, where we provide four examples of "foul shots," it can be seen that the visual perception of these four shots vary a lot (especially for Fig. 3a and all others), but Fig. 3a and Fig. 3b both cover the same event of the same player, which are captured Collection of segmented shots Video scene clustering Video scene detection Video group detection Event mining among video scene Audio features Visual features Video index, scalable video skimming and summary construction from different angles. With traditional video indexing mechanisms, these four shots will be indexed at different nodes (because they have different visual perceptions) and providing Fig. 3a as a query example may never work out results, like Fig. 3b (even if they do match with each other in semantics). With knowledge-based indexing, we can index them as one node (as long as we can detect this type of event), so the retrieval, browsing, and database management can be facilitated. When searching from a database constructed with the proposed indexing structure, the search engine can either include or exclude any index level to facilitate different types of queries. For example, if a user wants to query for a fours& sixs, regardless of the team names or the host association of the games (INDIA, ENGLAND, etc.), the search engine can inherently attain this goal by ignoring the first two levels of indexing (cluster and sub cluster in Fig. 2) at the search stage. In the system architecture in Fig. 4, we first parse a video sequence into physical shots and use a clustering algorithm to merge visually similar shots into groups. We then use dominant color detection to identify video groups that consist of court field shots and classify video shots into two categories: court and non-court. We also perform camera motion extraction, audio signal analysis, and video text detection and recognition to detect visual and audio cues. A hybrid sequence is constructed by integrating the temporal order and the audio and visual cues of each shot. An association mining scheme is designed to mine sequential associations from the sequence. Finally, we classify all mined associations and use them to construct video indexing.

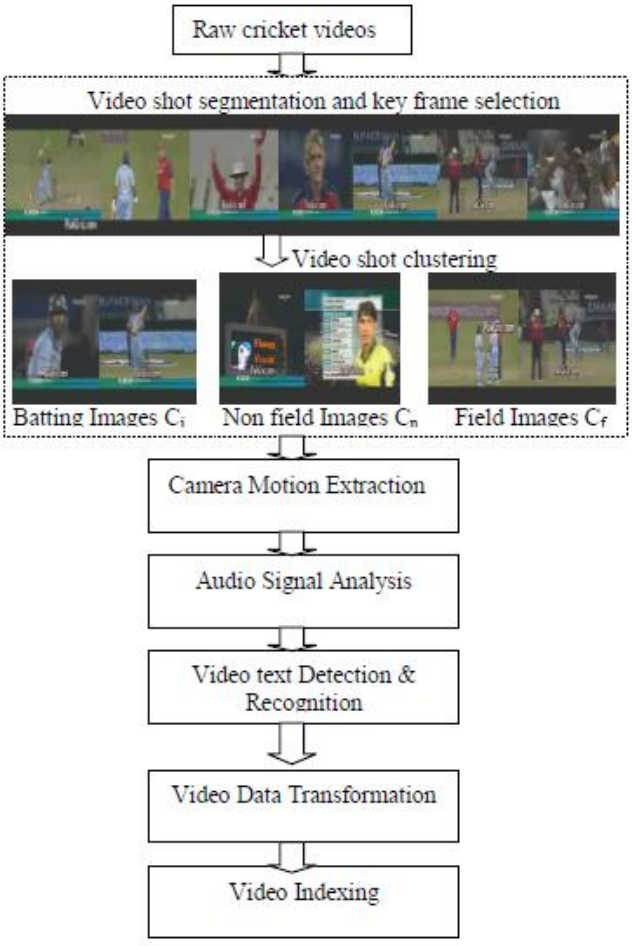

Figure 4- The architecture of associationbased video indexing

III. VIDEO CONTENT MININGSTRUCTURE

The video content structure is defined as a hierarchy of clustered scenes, video scenes, video groups and video shots (whose definitions are given below), increasing in granularity from top to bottom. Although there exist videos with very little content structure (such as sports videos, etc.), a content structure can be found in most videos from our daily life. the simplest way to parse video data for efficient browsing, retrieval and navigation is to segment the continuous video sequence into physical shots, and then select representative frame(s) for each shot to depictits content information. However, a video shot is a physical unit and is usually incapable of conveying independent semantic information. Accordingly, various approaches have been proposed to parse video content or scenario information.

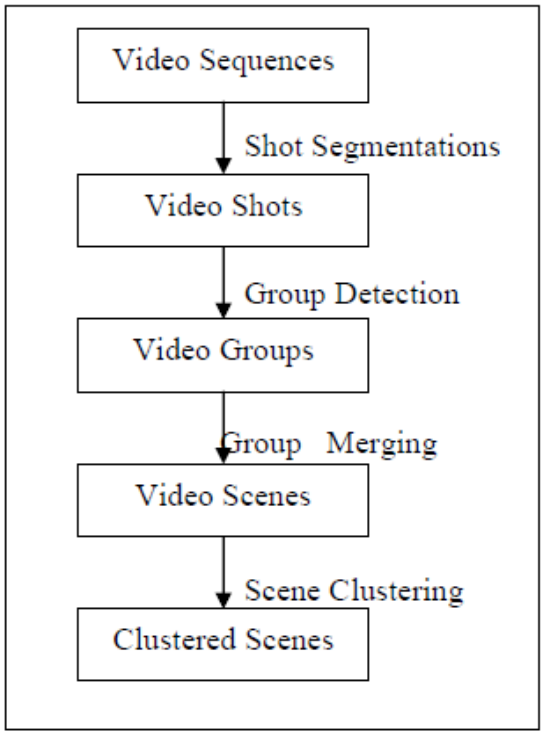

Figure 5- Pictorial video Content Structure

Usually, the simplest way to parse video data for efficient browsing, retrieval and navigation is to segment the continuous video sequence into physical shots, and then select representative frame(s) for each shot to depict its content information. However, a video shot is a physical unit and is usually incapable of conveying independent semantic information. Accordingly, various approaches have been proposed to parse video content or scenario information. Zhong et.al proposes a strategy which clusters visually similar shots and supplies the viewers with a hierarchical structure for browsing. However, since spatial shot clustering strategies consider only the visual similarity among shots, the video context information is lost. To address this problem, Rui et. al presents a method which merges visually similar shot into groups, then constructs a video content table by considering the temporal relationships among groups. The same approach is reported. A time-constrained shot clustering strategy is proposed to cluster temporally adjacent shots into clusters, and a Scene Transition Graph is constructed to detect the video story unit by utilizing the acquired cluster information. A temporally time-constrained shot grouping strategy has also been proposed. The most efficient way to address video content for indexing, management, etc. is to acquire the video content structure. As shown in Fig. 1, our video content structure mining is executed in four steps:

(1) Video shot detection,
(2) Group detection,
(3) Scene detection, and
(4) Scene clustering.

a) Video Shot Detection

To support shot based video content access, we have developed an efficient shot cut detection technique. Our shot cut detection technique can adapt the threshold for video shot detection according to the activities of various video sequences, and this technique has been developed to work on MPEG compressed videos. Unfortunately, such techniques are not able to adapt the thresholds for different video shots within the same sequence.

In order to adapt the thresholds to the local activities of different video shots within the same sequence, we use a small window (i.e., 30 frames in our current work) and the threshold for each window is adapted to its local visual activity by using our automatic threshold detection technique and local activity analysis. The video shot detection result shown in Fig.5 is obtained from one video data source used in our system. It can be seen that by integrating local thresholds, amore satisfactory detection result is achieved (The threshold has been adapted to the small changes between adjacent shots, such as changes between eyeballs from various shots in Fig. 5, for successful shot segmentation). After shot segmentation, the 10th frame of each shot is taken as the keyframe of the current shot, and a set of visual features (256 dimensional HSV color histogram and 10 dimensional tempura coarseness texture) is extracted for processing

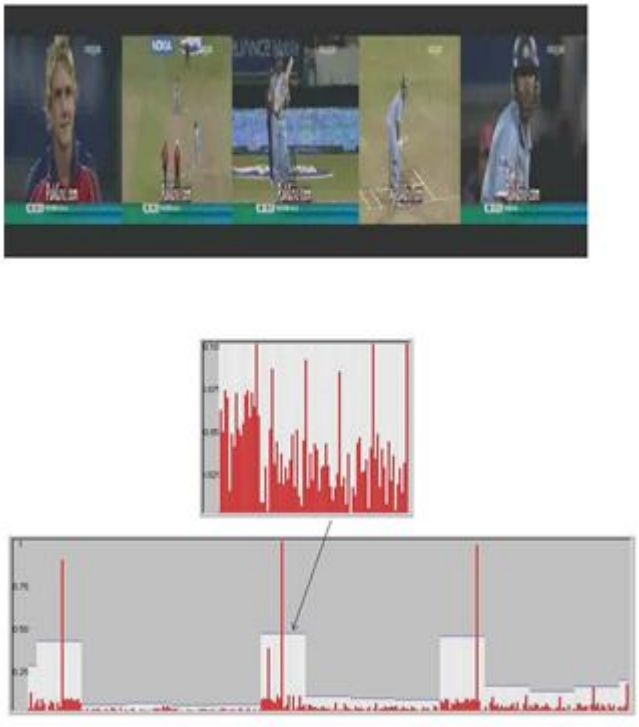

Figure 6 -The video shot detection results from a cricket video:
(a) Part of the detected shot boundaries;
(b) The corresponding frame difference and the determined threshold for different video shots, where the small window shows the local properties of the frame differences.

b) Video shot clustering.

The continuous video sequence is first segmented into physical shots, and the videoshots are then grouped into semantically richer groups. Afterward, similar neighboring groups are merged into scenes. Beyond the scene level, a cluster scheme is applied to eliminate repeated scenes in the video. Finally, the video content structure is constructed. To apply existing data mining techniques on video data, one of the most important steps is to transform video from non-relational data into a relational data set. To facilitate this goal, we adopt a series of algorithms to explore audio and visual cues. We start with a raw video sequence and output symbolic sequences that indicate where and what types of cues appear in the video. we have clustered video shots into groups, and classified each group into two categories: the first consists of court field shots (GroupA) and the second consists of non-court field shots (GroupB). To evaluate the performance of our clustering algorithm, we manually classify video groups into these two categories, and then count the number of shots in GroupA which do belong to GroupA (i.e., shots which contain a court field and are clustered into a group which mainly consists of court field shots),and denote this number by FA. We also count the number of shots in GroupB which do belong to GroupB, and denote this number by FB. The clustering accuracy of each category is defined by Eq. (11), where STNA and STNB represent the number of shots contained in groups which belong to GroupA and GroupB respectively.

AccuracyA= FA / STNA ;AccuracyB= FB / STNB …….(1) To evaluate the performance of the group classification, we count the number of groups that belong to GroupA and GroupB, and denote these two numbers by GPNumA and GPNumB respectively. Also, we denote the number of groups which belong to GroupA and are correctly classified as GroupA by GFA, and similarly, the number of groups belonging to GroupB and are correctly classified as GroupB is denoted by GFB. The accuracy of group classification is defined by Equation (12).GAccuracyA= GFA / GPNumA; GAccuracyB= GFB / GPNumB ……..(2)

We perform experiments on four videos and present their results in Table 4. The results in Table 4 indicate that the proposed clustering algorithm is very successful on basketball videos. On average, the accuracy of GroupA and GroupB are 0.914 and 0.898 respectively, that is, only a small percentage of shots are falsely clustered into the wrong cluster. We have used this algorithm to test other types of videos, e.g., movies, news and medical videos, and found the results from the basketball videos are remarkably better. One reason is that a basketball video is usually captured from cameras at different locations and views of the same stadium. Hence, the proposed features and distance functions can efficiently address visual differences. As shown in Fig. 5, court field shots are likely to be merged into groups with each group being characterized by the camera from a certain view. With the results in Table 1, we can find that the dominant color can be used to classify court shots in basketball videos. In all GroupA groups, the accuracy is satisfactory, because court field shots do exhibit

a distinct dominant color. However, we notice that more GroupB groups are falsely classified as GroupA. The reason is that these groups likely contain some specially edited shots. E.g., a tag "look back" indicates the subsequent shots are a review, and the "tag" shot likely contains the "yellow" dominant color. Fortunately, the number of these types of shots is very limited, and on the other hand, these shots do not have other valuable visual or audio cues. Even if we falsely classify them as court shots, they won't bring much trouble into our algorithms.

*c) **V**ideo Shot Classification*

Physical video shots that are implicitly related to content changes among frames are widely used in various video database systems. To support shot-based video content access, we have developed a shot cut detection technique, which uses color features in each frame to characterize content changes among frames. The boundaries of shots are then determined by a threshold that is adjusted adaptively by using a small window (30 frames in our current work). After shot segmentation, we try to classify each shot into two categories: court and non-court. We first cluster visually similar shots into groups and then use the dominant color to identify groups which consist of court field shots because the court field in most sports can be described by one distinct dominant color . To facilitate this goal, we use the 10th frame of each shot as its representative frame (key frame) 1 and then extract two visual features from each key frame. When constructing a color histogram, we quantize H, S, and V into 16, 4, and 4 bins, respectively, so that the histogram of each image is characterized by a 256-dimensional vector and the total number of feature dimensions is 266. Given a video in the database, we assume it contains N shots S1; S2; . . . ; SN and denote the key-frame of Si by Ki. Suppose Hi,l, l € [0, 255], and TCi,n, n € [0, 9] are the normalized color histogram and texture of Ki. The distance between shots Si and Sj is defined by (1), where WC and WT indicate the weight of each feature:

$$Dis(Si,Sj) = Wc\{1-\sum_{l=0}^{255} \min(Hi,l,Hj,l)\} + WT \sqrt{\sum_{}^{9} (TCi,n - TCj,n)}$$

(3) We want to group shots that are similar into a cluster. In addition, different clusters should have sufficiently different characteristics. Hence, we adopt a modified split-and-merge clustering algorithm by sequentially executing two major procedures: merging and splitting. In the merging procedure, we iteratively merge the most similar clusters until the distance between the most similar clusters is larger than a given threshold. Nevertheless, this merging procedure may generate clusters with a large intra-cluster distance. Accordingly, after the merging procedure, we turn to the splitting procedure to split clusters with large visual variances. We iteratively calculate the intra-cluster distance for any cluster Ci, the cluster with its intracluster distance larger than a given threshold is separated into two clusters until all clusters have their intra-cluster distance less than the given threshold. Let's denote the ith cluster by Ci and the number of members in Ci by Ni, where each element (Si, l =1,……., Ni) in the cluster is a shot. The intra-cluster distance between Ci and Cj is defined by (4):

$$Dmin(Ci,Cj) = \min_{S_i^k \in Ci, S_j^l \in Cj, l=1,..,Ni, k=1,...,Nj} Dis(S_i^k, S_j^l) \quad \ldots\ldots (4)$$

We then define the intra-cluster distance of C_i by (5):

$$D(Ci) = \max_{S_i^l \in Ci, S_i^k \in Ci; l \neq k, l=1,..Ni, k=1,..,Ni} Dis(S_i^l, S_i^k) \quad (5)$$

After we have clustered visually distinct shots into groups, we can use the dominant color (usually, a tone of yellow) to identify groups that consist of court field shots. However, even though the color of the court field is likely a tone of yellow, the actual color may vary from stadium to stadium and also change with lighting conditions. Therefore, we cannot assume any specific value for this dominant color, but learn it adaptively. We randomly sample N frames from video sequences (in our system, we set N = 50). Because sports videos usually focus on the court field, most of these N frames will contain the court field.

d) Video group detection

The shots in one group generally share a similar background or have a high correlation in time series. Therefore, to segment the spatially or temporally related video shots into groups, a given shot is compared with shots that precede and succeed it (using no more than 2 shots) to determine the correlation between them, as shown in Fig.4.

We adopt 256-color histogram and 10tamura coarseness texture for visual features. Suppose Hi,j, j.[0,255] and Ti,j,j.[0,9] are the normalized color histogram and texture of the key frame i. The similarity between shot i, j is defined by Eq. (1).

$$StSim(Si,Sj) = Wc \sum_{K=0}^{225} \min(H_{i,k}, H_{j,k}) + W_T \left(1 - \sqrt{\sum_{K=0}^{9} (T_{i,k}, T_{j,k})}\right) \quad (6)$$

where W_C and W_T indicate the weight of color and tamura texture. For our system, we set W_C=0.7, W_T=0.3. In order to detect the group boundary using the correlation among adjacent video shots, we define the following similarity distances and A separation factor R(i) for shot Si is then defined by Eq.(6) to evaluate a potential group boundary.

$$R(i) = \frac{CRi + CRi+l}{CLi + CLi+l} \quad .(7)$$

The shot group detection procedure takes the following steps:

Given any shot S_i, if CR_i is larger than T2-0.1:

IV. EVENT MINING AMONG AUDIO AND VIDEO SCENES

After the video content structure has been mined, the event mining strategy is applied to detect the event information within each detected scene. A successful result will not only satisfy a query such as "Show me all dialogs within the

video", it will also bridge the inherent gap between video shots and their semantic categories for efficient video indexing, access and management. Since cricket videos are mainly used for entertainment purposes, the video content is usually recorded or edited using the style formats described below.

(a) Using presentations of players or experts to express the general topics of the video.

(b) Using pitch conditions to present details of the match forecasting, their team efforts, comparisons and winning possibilities, etc.

(c) Using dialog between the team players and batman's to acquire other knowledge about their behavior.

In this section, visual/audio features and rule information are integrated to mine these three types of events.

1. *Visual feature processing*

Visual feature processing is executed among all representative frames to extract semantically related visual cues. Currently, five types of special frames and regions are detected: slides or clip art frame, black frame, frame with face, frame with shots and frame with bowlers, as shown in Fig. Due to the lack of space, we will describe only the main idea; algorithm details can be found in . Since the slides, clip art frames and back frames are man-made frames, they contain less motion and color information when compared with other natural frame images. They also generally have very low similarity with other natural frames, and their number in the video is usually small. These features are utilized to detect slides, clip art and black frames.

Following this step, the videotext and gray information are used to distinguish the slides, clip art and black frames from each other. To detect the faces, fours and six's regions, Gaussian models are first utilized to segment the shots, and then a general shape analysis is executed to select those regions that have considerable width and height. For skin-like regions, texture filter and morphological operations are implemented to process the detected regions. A facial feature extraction algorithm is also applied. Finally, a template curve based face verification strategy is utilized to verify whether a face is in the candidate skin region.

2. *Audio feature processing*

Audio signals are a rich source of information in videos. They can be used to separate different speakers, detect various audio events, etc. In this paper, our objective is to verify whether speakers in different shots are the same person. The entire classification can be separated into two steps:Select the representative audio clip for each shot, and Compare whether representative clips of different shots belong to the same speaker.

2.1 Salient Audio Event Detection

To evaluate the performance of the proposed salient audio event detection in Section 3.4, we apply our methods on one NBA video (which lasts about 70 minutes). We manually go through the video to evaluate each detected audio event, and present the results in Table 6. One can find that by adopting the proposed pitch feature, we can distinguish applause from other events with a satisfactory result, where the average precision and recall are 80.6% and 76.3% respectively. However, the precision of the whistle detection algorithm is pessimistic (52.5%), although the recall of this method is very successful, 97%. Further analysis shows that in basketball videos, other events, such as the trumpets of cheering squads or the audience and the grating between players' shoes and the floor, have similar behaviors as whistles, because their energy concentrates on a small frequency region for a short time. The proposed whistle detection algorithm therefore also takes these events as whistle. Consequently, the precision of whistles becomes relatively poor, but we can still attain a very good recall value. In sports videos, some special audio events, e.g., audience applause and a referee's whistle, will help us acquire some semantic cues. Generally, audience applause occurs when exciting events happen, e.g., shooting and/or a goal, and a referee's whistle may imply an interruption or another special event. To detect audience cheering, we use the pitch of audio signal. Basically, pitch is the fundamental frequency that reveals harmonic properties of audio and is an important parameter in the analysis and synthesis of speech signals. In comparison with voice and music, the pitch value of audience applause is very small. In most cases, this value in sports videos is zero because, when cheering happens, the audio signal exhibits a constant high value noise that likely drowns out other audio signals, e.g., the voice of the anchorperson or the music. We therefore extract the pitch for each audio frame. In our system, the audio frame length is 20ms and the frame shift is 0ms. Because the duration of cheering usually exceeds 1 second, we apply cheering detection on each 1-second segment. For each segment, we calculate the Non Zero Pitch Ratio (NZPR), which is defined as the ratio between the number of frames whose pitch is not zero and the total number of frames in a segment. For a cheering segment, its NZPR value likely exhibits a small value, and a simple threshold scheme can distinguish cheering segments from others. Fig. 10 shows the results of NZPR values from a test sports video with one minute duration, where four cheering events appear at 3s-9s, 20s-25s, 41s-44s, and 54s57s. To detect a referee's whistle, we use spectrum domain features. Fig. 11demonstrates the spectrum an audiosegment that contains two whistles.

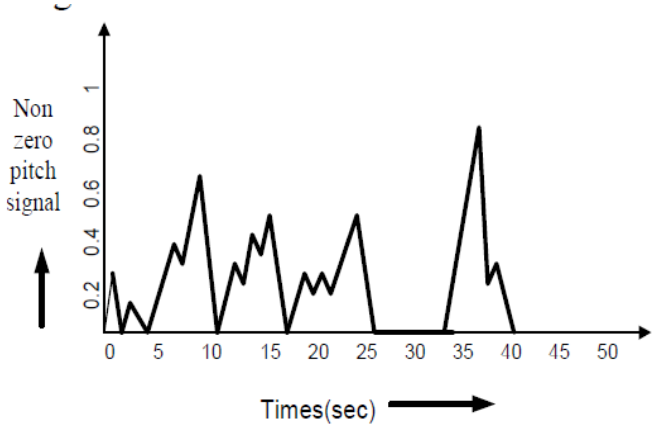

Fig.10 Non zero pitch ratio from an audio signal.

The regions with a circle margin correspond to the spectrum when the referee whistles. One can find that, in frequency regions between 3500Hz to 4500Hz, the energy of a whistle is much higher than others. We then calculate the energy ratio between frequency 3500Hz and 4500Hz for each audio frame to detect whistles. We split the whole frequency into B sub bands. Given audio frame i and subband j, we define the band energy ratio (BER) by (7), where $DFT_{I,k}$ is the *Discrete Fourier Transformation*of the audio frame i and E is the order of DFT coefficients. In our system, the sampling rate for audio signals is 22050Hz and B is 12. Thus, the frequency of the fifth sub band is 3675 ~ 4594Hz. Then, we calculate the segment band energy ratio of the fifth sub band (SBER5) during a short time period (0.5s) by (8), where AF is the total number of audio frames in this period. Fig. 12 shows the results of SBER5 values from a test sports video of about 200 seconds in length. The regions with a circle margin correspond to whistle events. We can then involve some threshold mechanisms to find out the location of those whistle events.

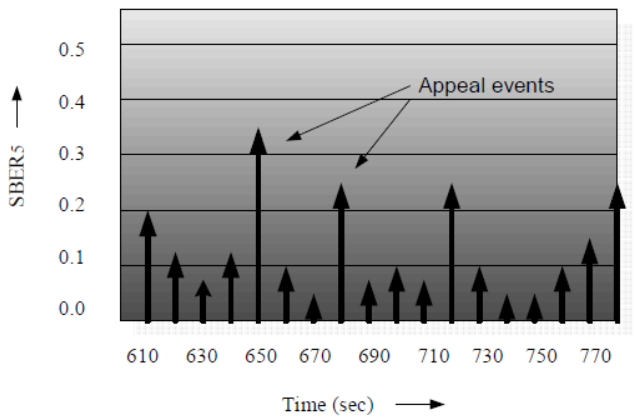

Fig-11.Segment band energy ratio of the fifth sub band from an audio with multiple whistle events.

$$BER_{i,j} = \sum_{e=E(j-1)/B}^{Ej/B} DFTi,e \,/\, \sum_{e=1}^{E} DFTi,e,$$

$$SBER_5 = 1/AF \sum_{i=1}^{AF} BER_{i,5}. \quad \ldots\ldots (8)$$

3. *Event mining strategy*

Given any mined scene *SEi*, our objective is to verify whether it belongs to one of the following event categories:

1. A "**Presentation**" scene is defined as a group of shots that contain slides or clip art frames. At least one group in the scene should consist of temporally related shots. Moreover, at least one shot should contain a face close-up (human face with size larger than 10% of the total frame size), and there should be no speaker change between adjacent shots.

2. A "**Dialog**" scene is a group of shots containing both face and speaker changes. Moreover, at least one group in the scene should consist of spatially related shots. The speaker change should take place at adjacent shots, which both contain the face. At least one speaker should be duplicated more than once.

3. The "Fielding and Batting shots" scene includes cricket events, such as bowls, overs, wickets, etc. In this paper, I define the "Fielding and Batting shots" as a group of shots without speaker change, where at least one shot in *SEi* contains blood-red or a close-up of a six's or where more than half of the shots in *SEi* contain fours. Based on the above definitions, event mining is executed as follows.

3.1. Input all shots in *SEi* and their visual/audio preprocessing results.

3.2. Test whether *SEi* belongs to a "Presentation" scene: Ø If there is no slide or clip art frame contained in *SEi*, go to step 3. If there is no face close-up contained in *SEi*, go to step 3. Ø If all groups in *SEi* consist of spatially related shots, go to step 3. Ø If there is any speaker change between adjacent shots of *SEi*, go to step 3, Ø Assign the current group to the "Presentation" category; go to end or process other scenes.

3.3. Test whether *SEi* belongs to "Dialog": Ø If there is either no face or no adjacent shots which both contain faces in *SEi*, go to step 4. Ø If all groups in *SEi* consist of spatially related shots, go to step 4. Ø If there is no speaker change between all adjacent shots which both contain faces, go to step 4. Ø Among all adjacent shots which both contain face and speaker change, if there are two or more shots belonging to the same speaker, *SEi* is claimed as a "Dialog", otherwise, go to step 4.

3.4. Test whether *SEi* belongs to "Fielding and Batting shots": Ø If there is a speaker change between any adjacent shots, go to step 5. Ø If there are any close-up skin region or blood-red regions detected, *SEi* is assigned to "Fielding and

Batting shots". Ø If more than half of representative frames of all shots in *SEi* contain skin
regions, then *SEi* is assigned as "Fielding and Batting shots." Otherwise, go to step 5.
3.5. Claim the event in *SEi* cannot be determined and process another scene

V. ALGORITHM EVOLUTION

In this section, we present the results of an extensive performance analysis we have conducted to:
(1) evaluate the effectiveness of video scene detection and event mining,
(2) analyze the performance of our clusterbasedindexing framework, and
(3) assess the acquired video content structure in addressing video content.

a) Video scene detection and event mining results

To illustrate the performance of the proposed strategies, two types of experimental results, video scene detection and event mining, are presented. Our dataset consists of approximately 6 hours of *MPEGI*encoded medial videos which describe face repair, nuclear medicine, laparoscopy, skin examination, and laser eye surgery. Fig.7
presents the experimental results and comparisons between our scene detection algorithm and other strategies. To judge the quality of the detected results, the following rule is applied: the scene is judged to be rightly detected if and only if all shots in the current scene belong to the same semantic unit (scene), otherwise the current scene is judged to be falsely detected. Thus, the scene detection precision (*P*) in Eq. (18) is utilized for performance evaluation. P= Rightly detected scenes / All detected scenes…….. (18)
Clearly, without any scene detection (that is, treating each shot as one scene), the scene detection precision would be 100%. Hence, a *compression rate factor* (*CRF*) is defined in Eq. (19). CRF=Detected scene number / Total shot number……. (19) To show both *CRF* and *P* in the same figure, we multiply *CRF* by 10. We denote our method as *A*, and the two methods from the literature as *B* and *C,*
respectively. From the results in Fig. 6, some observations can be made: (1) our scene detection algorithm achieves the best precision among all three methods, about 65% shots are assigned to the appropriate semantic unit, (2) method *C*achieves the highest compression rate, unfortunately the precision of this method is also the lowest, and (3) as a tradeoff with precision, the compression ratio of our method is the lowest (*CRF*=8.6%, each scene consists of about 11 shots). We believe that in semantic unit detection, it is worse to fail to segment distinct boundaries than to over-segment a scene. From this point of view, our method isbetter than other two methods. After the video content structure has been mined, we manually select scenes which distinctly belong to one of the following event categories: presentation, dialog and clinical operation, and use them as benchmarks. We then apply the event mining algorithm to automatically determine their event category. The experimental results are shown in Table 1, where *PR* and *RE* represent the precision and recall which are defined in Eq. (20). On average, our system achieves relatively good performance (72% in precision and 71% in recall) when mining these three types of events. PR= True Number / Detected Number; RE= True Number / Selected Number…….. (20)

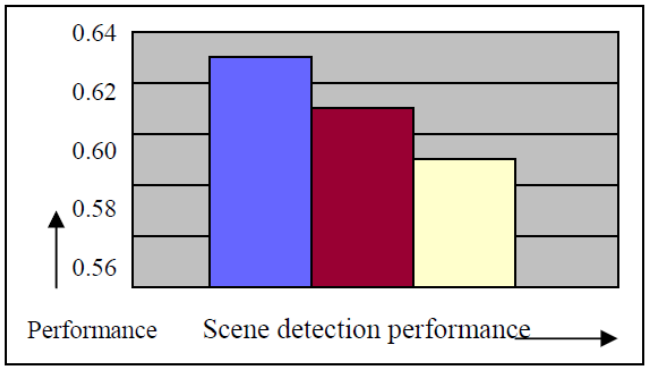

Figure 12. Scene detection performance

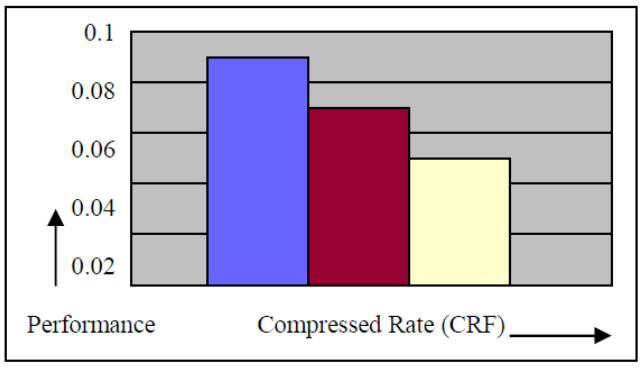

Figure 13-Compressed Rate

Table 1-Video event mining results

Events	Selected number	Detected number	True number	*PR*	*RE*
Presentation	15	16	13	0.81	0.87
Dialog	28	33	24	0.73	0.85
All Shot	39	32	21	0.65	0.54
Average	82	81	58	0.72	0.71

b) Scalable video skimming and summarization results

Based on the mined video content structure and events information, a scalable video skimming and summarization tool was developed to present at most 4 levels of video skimming and summaries. To evaluate.the efficacy of such a tool in addressingvideo content, three questions are introduced to evaluate the quality of the video skimming at each layer:
(1) How well do you think the summary addresses the main topic of the video?

(2) How well do you think the summary covers the scenarios of the video?
(3) Is the summary concise? For each ofthe questions, a score from 0 to 5 (5 indicates best) is specified by five student viewers after viewing the video summary at each level. Before the evaluation, viewers are asked to browse the entire video to get an overview of the video content. An average score for each level is computed from the students' scores (shown in Fig.14). From Fig.12, we see that as we move to the lower levels, the ability of the skimming to cover the main topic and the scenario of the video is greater. The conciseness of the summary isworst at the lowest level, since as the level decreases, more redundant shots are shown in the skimming. At the highest level, the video summary cannot describe the video scenarios, but can supply the user with a concise summary and relatively clear topic information. Hence, this level can be used to show differences between videos in the database. It was also found that the third level acquires relatively optimal scores for all three questions. Thus, this layer is the most suitable for giving the user an overview of the video selected from the database for the first time. A second evaluation process used the ratio between the numbers of frames at the skimming of each layer and the number of all frames (*RC)* to indicate the compression rate of the video skimming. Fig.15 shows the results of *RC* in various skimming layers. It can be seen that at the highest layer (layer 4) of the video skimming, a 10% compression rate has been acquired. This shows that by using the results of video content structure mining, an efficient compression rate can be obtained for addressing the video content for summarization, indexing, management etc

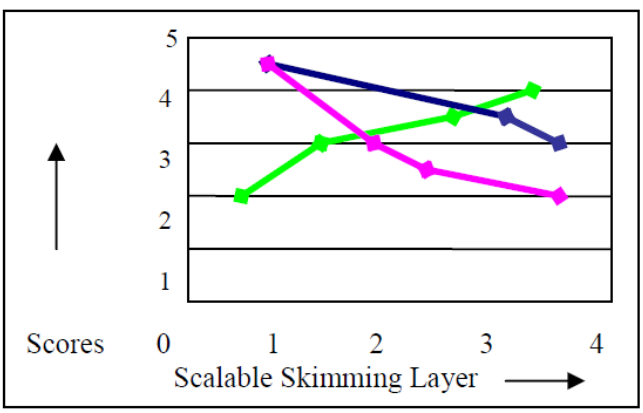

Figure 14. Scalable video skimming and summarization evaluation

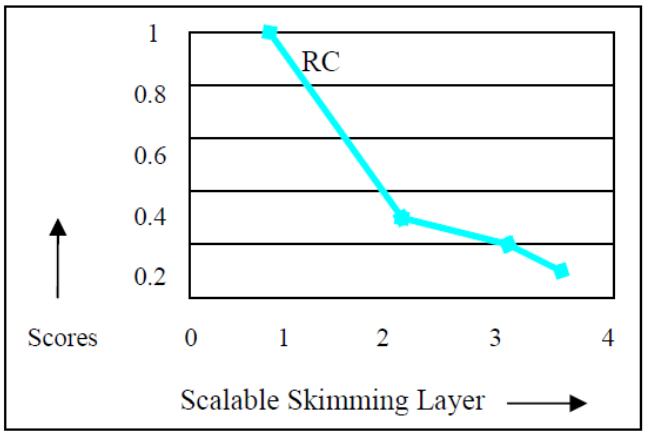

Figure 15. Compress frame ratio at various layers.

VI. Experimental Results

The results of an extensive performance analysis conducted to 1) evaluate the video processing techniques, 2) evaluate the video association mining and segmented slots of full constructed videos based on indexing algorithm, Section 4 analyze the audio cues for non-zero pitch signal .the algorithm is supported by a cricket video captured from www.cricktelive.com having a total length of 7.15 sec.

VII. Conclusions and Remarks

In this paper, we have proposed a solution for a new research area of video mining video association mining. We have used video associations to construct a knowledgebased video indexing structure to support efficient video database management and access. We have introduced various techniques to extract visual and audio semantic cues and combined them into one hybrid stream by considering their original temporal order in the video. Consequently, the video data is transformed into a relational data set. We have employed a sequential multilevel association mining strategy to mine associated video items and take them as video associations. We have adopted a scheme to classify associations into different categories, where each association can possibly indicate the happening of one type of event. The knowledge-based video indexing structure is accomplished by mining and classifying associations from video data. We have presented experimental results to demonstrate the performance of the proposed schemes. We believe we have explored a new research area to discover video knowledge for efficient video database management. While the strategies presented in this paper are specific tobasketball videos, mining associations for video knowledge exploration is an essential idea we want to convey here. From this point of view, further research could be conducted on the followingaspects: 1) Extend the current framework to other domains and evaluate the performance of the video mining algorithm in environments containing more events. We believe the most promising domain is the surveillance video, where the routine vehicles in security areas normally comply with some associations like enter

!stop !drop off !leave and a vehicle which does not comply with this association might be problematic and deserves further investigation. However, due to the inherent differences between different video domains (e.g., the concept of shot and video text do not exist in surveillance videos), we may need more efforts to analyze the video content details for association mining, e.g., extract trails and status of moving objects to characterize associations.

2) We have adopted various video processing techniques to explore visual and audio cues for association mining and it will inevitably incur information loss from the original video sequences to transferred symbolic streams; more studies are needed to address this issue in the mining activities.

3) The mining algorithms in this paper are mainly derived from the existing data mining schemes (with some extensions for video mining scenarios); extensive studies are needed to explore efficient mining algorithms which are unique for mining knowledge from video data.

VIII. Acknowledgment

In the course of developing this paper, I have been deeply indebted to my guide Mr.Mahendra Kumar faculty in the Bundhelkhand Institute of Engg. And Technology for their knowledge and guidance that have helped shaped this paper to its present form. Without his kindest effort and arrangement, this paper will not be able to complete.

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Design and Analysis of Rectangular Microstrip Antennas with Enhanced Bandwidth

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GJRE Classification (FOR) 100501, 291701

***Abstract*- Microstrip antennas are well suited for wireless and mobile application due to their low weight, low volume and low sensitivity to manufacturing tolerance. In this paper we analyze the properties and design method of Microstrip antenna and then design the Microstrip antenna with MATLAB using cavity model method and simulate it with IE3D based on MOM method. At last, we compared the simulated and theoretical results.**

Index Terms- Bandwidth, Directivity, Microstrip Antenna, Method of Moment (MOM).

I. INTRODUCTION

With the development of MIC and HF semiconductor devices and printed circuits have drawn the maximum attention of the antenna community in recent years. In spite of its various attractive features like light weight, low cost, easy fabrication, conformability on curved surface and so on, the Microstrip element suffers from an inherent disadvantage of narrow impedance bandwidth and low gain. In principle, bandwidth enhancement can be achieved by several approaches [1]. In this paper coaxial feed technique is used as they occupies less space and have low spurious radiations by using Teflon connector. The Method of Moment (MOM) is used to discuss the electromagnetic radiation characteristic of the Microstrip antenna [2].

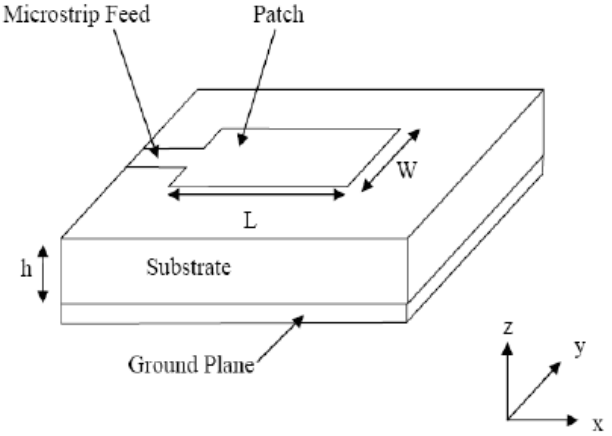

Figure1. Microstrip patch antenna

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II. ANALYSIS OF MICROSTRIP PATCH ANTENNA

Microstrip patch antenna can be designed by using a cavity model [3] suitable for moderate bandwidth antennas. The lowest order mode, TM_{10}, resonates when effective length across a patch is half of wavelength. Radiations occur due to fringing field.

1) *Resonance Frequency*

The resonance frequency f_{mn} depends on the patch size, cavity dimensions, and the filling material dielectric constant, as follows:-

$$f_{mn}=\frac{K_{mn}\,C}{2\pi\sqrt{\varepsilon_r}} \quad (1)$$

Where m, n = 0, 1, 2… K_{mn} = wave number at m, n mode, C is the velocity of light, ε_r is the dielectric constant of the substrate, and

$$K_{mn}=\sqrt{\left(\frac{m\pi}{W}\right)^2+\left(\frac{n\pi}{L}\right)^2} \quad (2)$$

For TM_{01} mode, length and width of non-radiating rectangular patch's edge at a certain resonance frequency and dielectric constant is given by:

$$L=\frac{C}{2f_r\sqrt{\varepsilon_r}} \quad (3)$$

$$W=\frac{C}{f_r}\sqrt{\frac{2}{\varepsilon_r+1}} \quad (4)$$

Where f_r is the resonance frequency at which the rectangular Microstrip antenna is to be designed. The radiating edge W, patch width is usually kept such that it lies within the range L<W>2L for efficient radiation. The ratio W/L=1.5 gives good performance according to the side lobe appearances. The actual value of resonant frequency is slightly less than f_r because fringing effect causes the effective distance between the radiating edges of the patch to be slightly greater than L. By using the above equations we can find the values of actual length of the patch as:

$$L=\frac{C}{2f_r\sqrt{\varepsilon_{eff}}}-2\Delta l \quad (5)$$

Where ε_{eff} is the effective dielectric constant and Δl is the line extension which is given as:-

$$\varepsilon_{eff} = \left(\frac{\varepsilon_r+1}{2}\right) + \left(\frac{\varepsilon_r+1}{2}\right).\frac{1}{\sqrt{1+12\frac{h}{W}}} \qquad (6)$$

$$\frac{\Delta l}{h} = 0.412\frac{\left(\varepsilon_{eff}+0.3\right)\left(\frac{W}{h}+0.264\right)}{\left(\varepsilon_{eff}-0.258\right)\left(\frac{W}{h}+0.8\right)} \qquad (7)$$

2) Cavity Model

Transmission line model ignores field variations along the radiating edges. This disadvantage can be overcome by using cavity model in which interior region of dielectric substrate ismodeled as cavity bounded by electric walls on the top and bottom. The basis for the assumption is the following observations for thin substrate $(h \ll \lambda)$.Since the substrate is thin; the field in interior region do not vary much in Z direction, that is normal to the path.

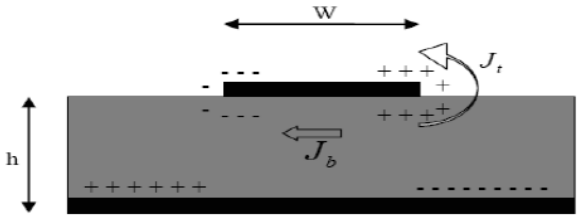

Figure2. Charge distribution and current density creation on the patch

Consider Figure 2, when the microstrip patch is provided power, a charge distribution is seen on the upper and lower surfaces of the patch and at the bottom of the ground plane. This charge distribution is controlled by two mechanisms-an attractive mechanism and a repulsive mechanism. The attractive mechanism is between the opposite charges on the bottom side of the patch and the ground plane, which helps in keeping the charge concentration intact at the bottom of the patch. The repulsive mechanism is between the like charges on the bottom surface of the patch, which causes pushing of some charges from the bottom, to the top of the patch. As a result of this charge movement, currents flow at the top and bottom surface of the patch. The cavity model assumes that the height to width ratio (i.e. height of substrate and width of the patch) is very small and as a result of this the attractive mechanism dominates and causes most of the charge concentration and the current to be below the patch surface. Much less current would flow on the top surface of the patch and as the height to width ratio further decreases, the current on the top surface of the patch would be almost equal to zero, which would not allow the creation of any tangential magnetic field components to the patch edges. Hence, the four sidewalls could be modeled as perfectly magnetic conducting surfaces.

III. Design Parameters of Proposed Antenna

The various design parameters of antenna which are calculated using the standard equations (1-7) are as follows:-
Substrate material used is glass epoxy.
Thickness of dielectric substrate h = 1.6mm
Relative permittivity of substrate = 4.2
Design frequency f = 2.5 GHz
Step size = 0.2
Width of patch W = 37mm
Length of patch L = 29mm

IV. Simulation and Result Analysis

By using MATLAB [4], we find the values of S_{11} mode and VSWR on feeding points (1, 1) and (2, 2) and also simulate the proposed antenna with IE3D [5]. Finally compared output of simulated and theoretical results with the support of various graphs and charts.All the antenna parameters are firstly calculated and plotted by using MATLAB coding and then simulated by IE3D based on Method of Moment.

Simulated Results At Feed Point (1, 1)

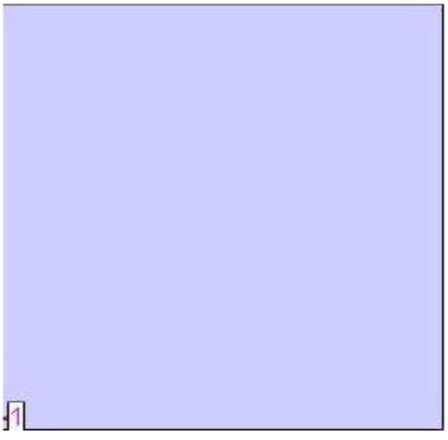

Figure3. Antenna shape with feed point

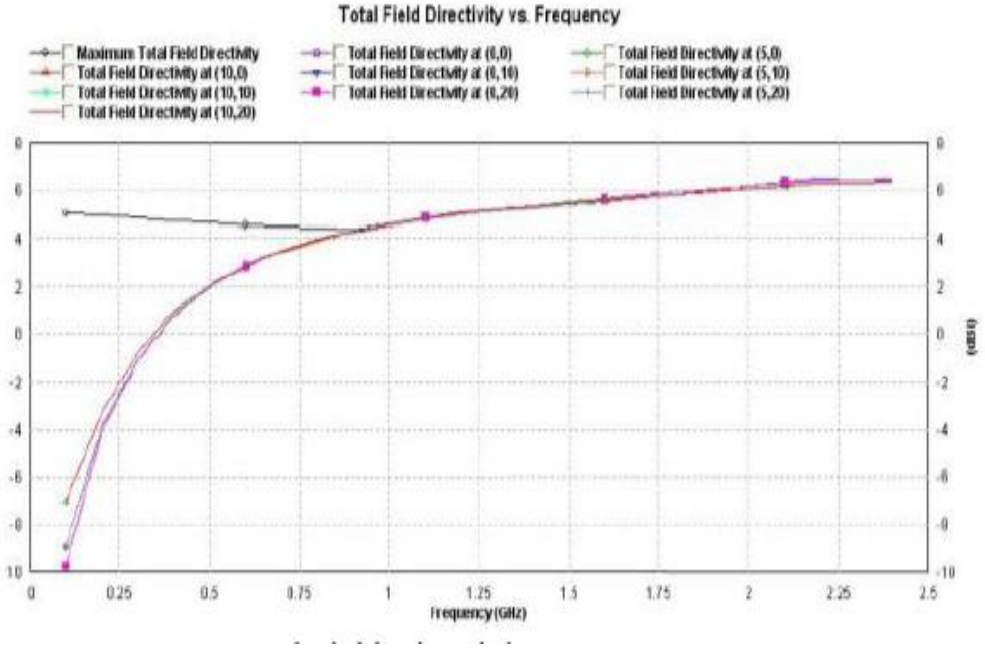

Figure4.Total Field Directivity versus Frequency curve.

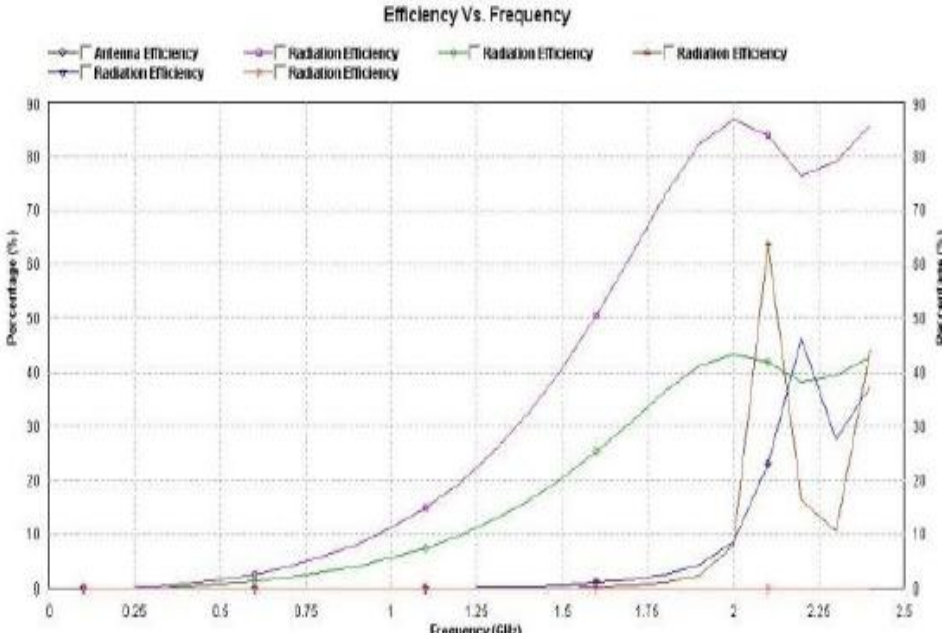

Figure 5. Efficiency versus Frequency Curve.

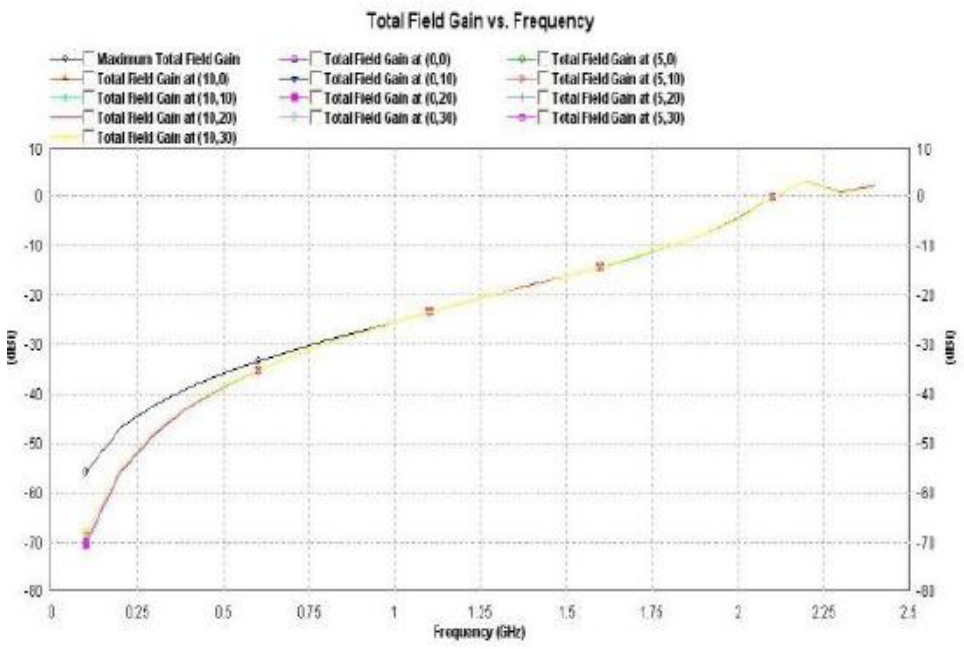

Figure 6. Total Field Gain versus Frequency curve.

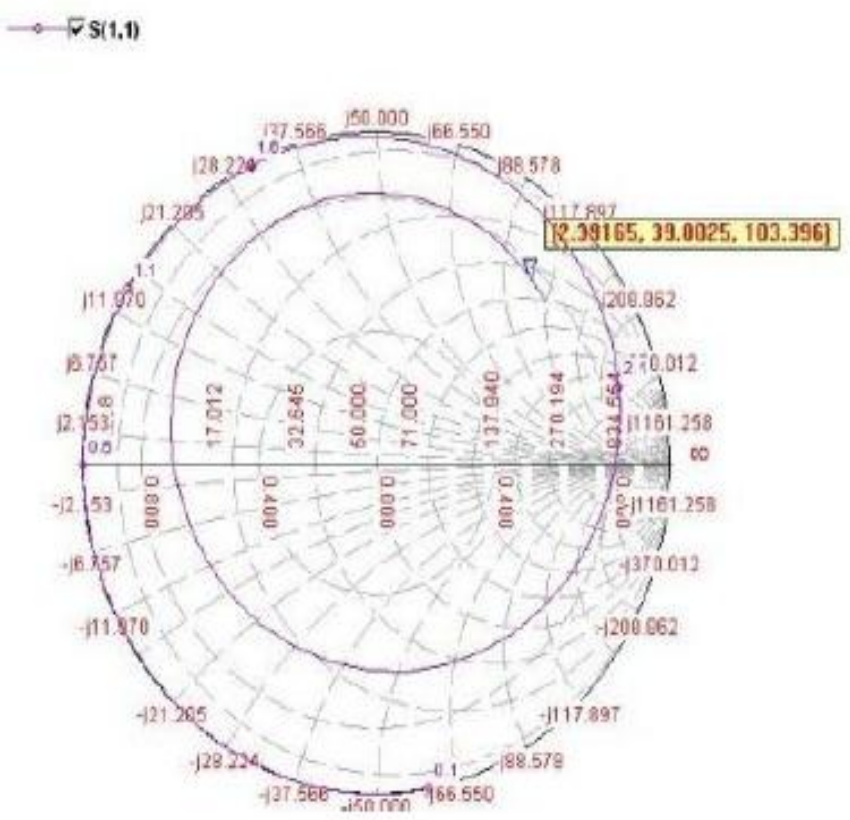

Figure 7. Smith Chart

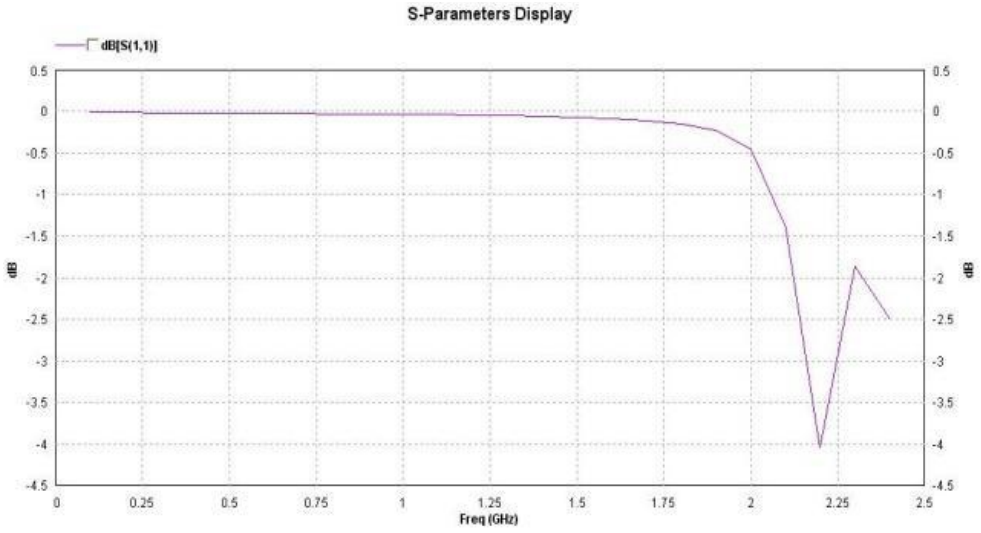

Figure 8. S- Parameter curve

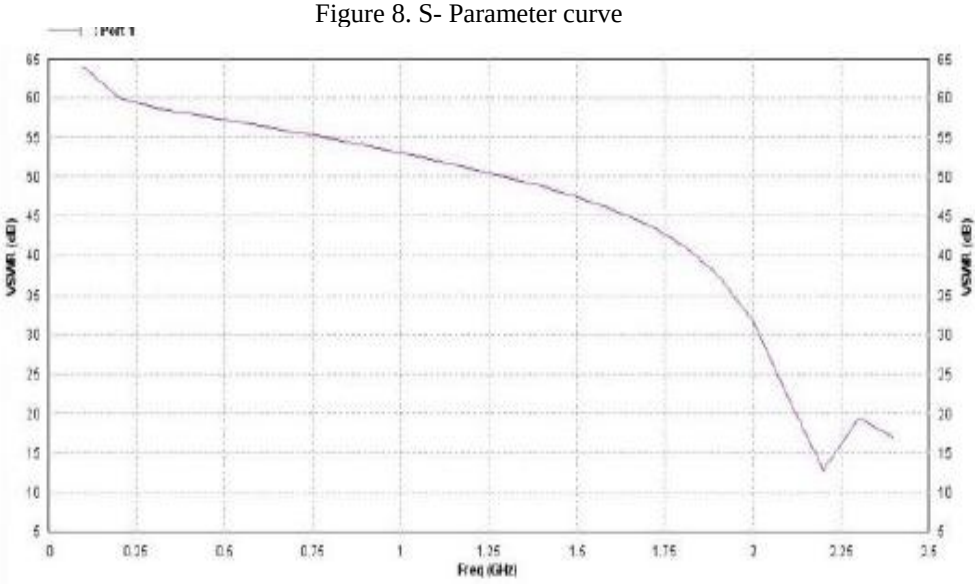

Figure 9. VSWR Curve.

Simulated Results At Feed Point (2, 2)

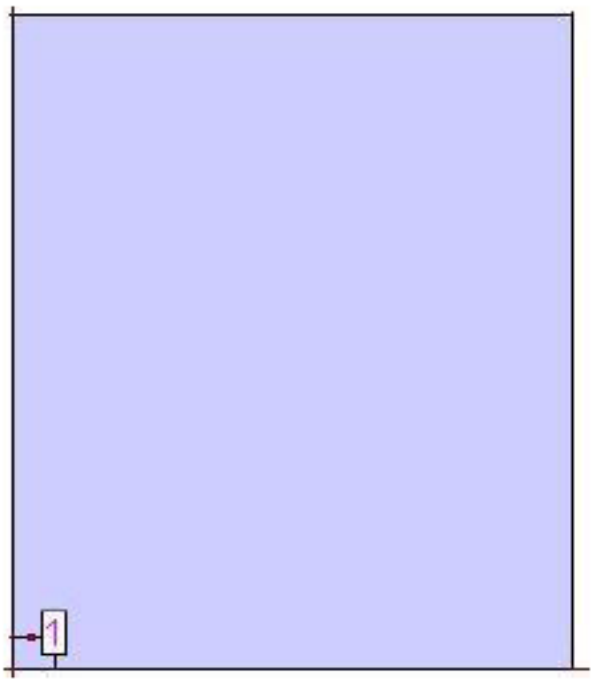

Figure10. Antenna shape with feed point.at (2, 2)

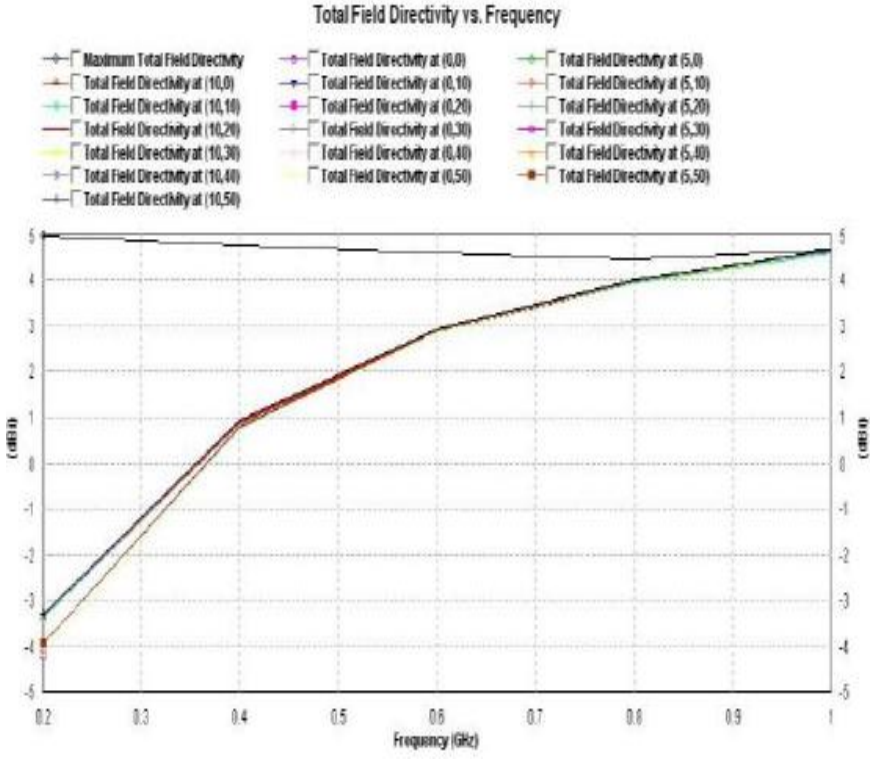

Figure11. Total Field Directivity versus Frequency curve.

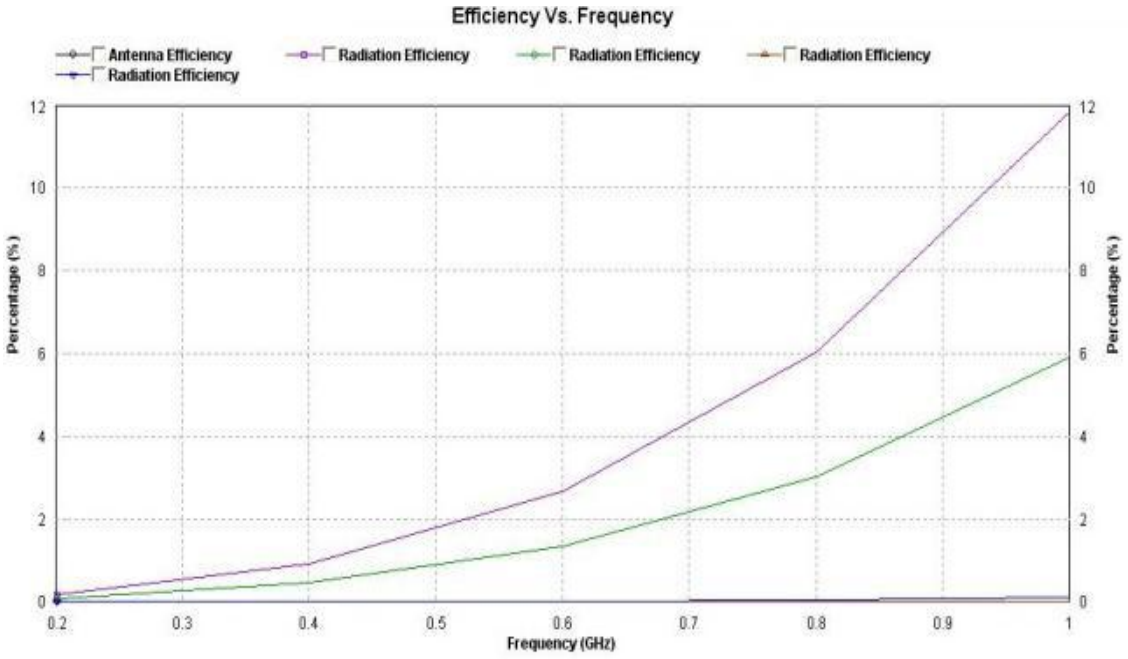

Figure12. Efficiency versus Frequency Curve

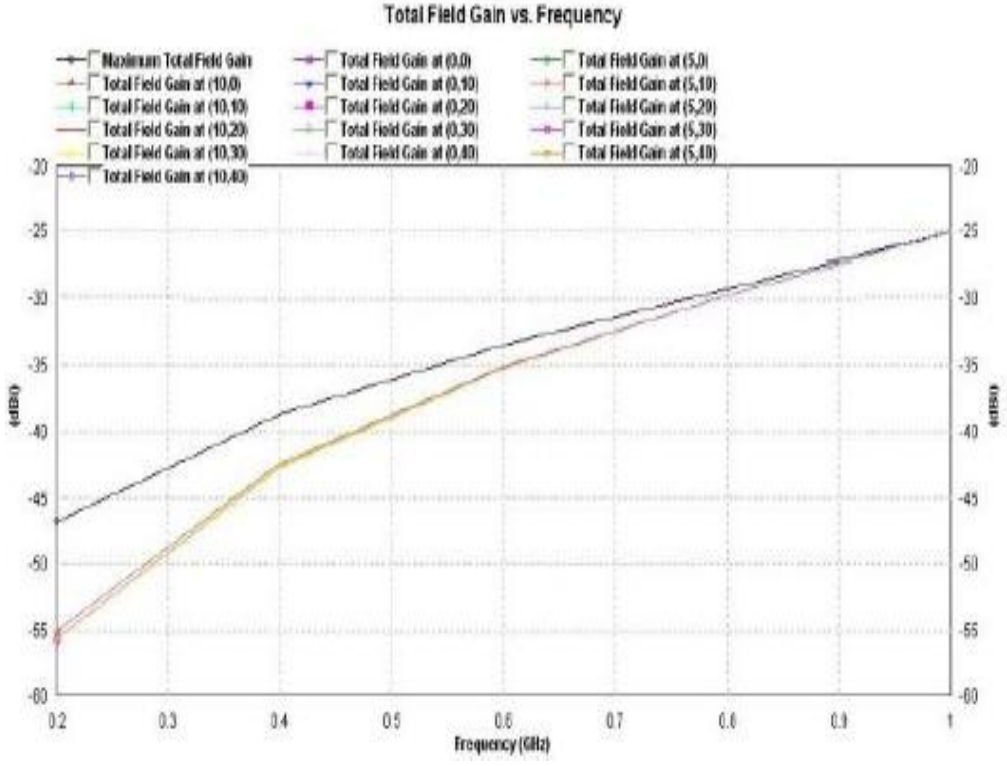

Figure13. Total Field Gain versus Frequency curve

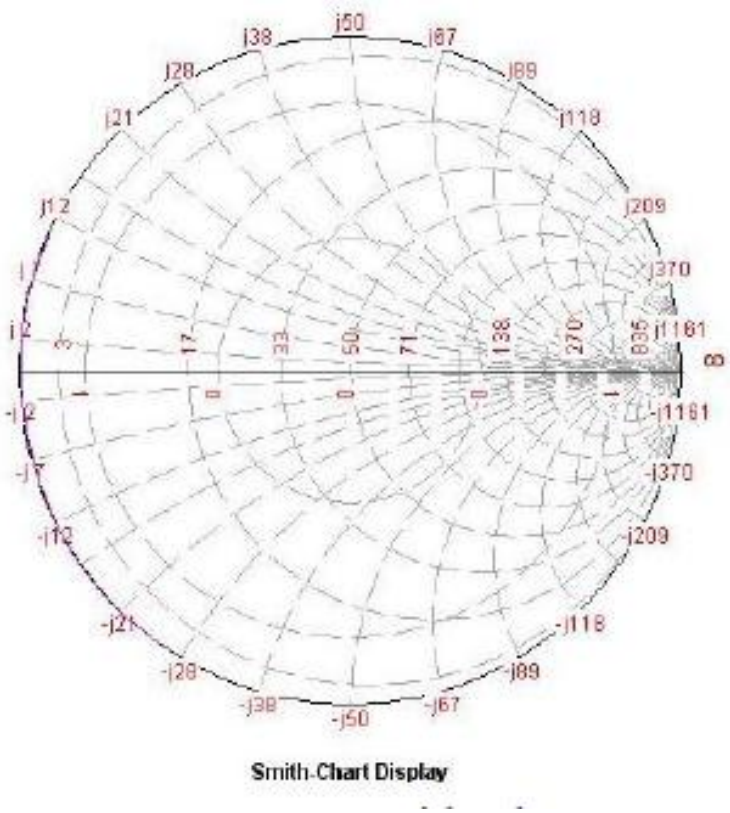

Figure14. Smith Chart.

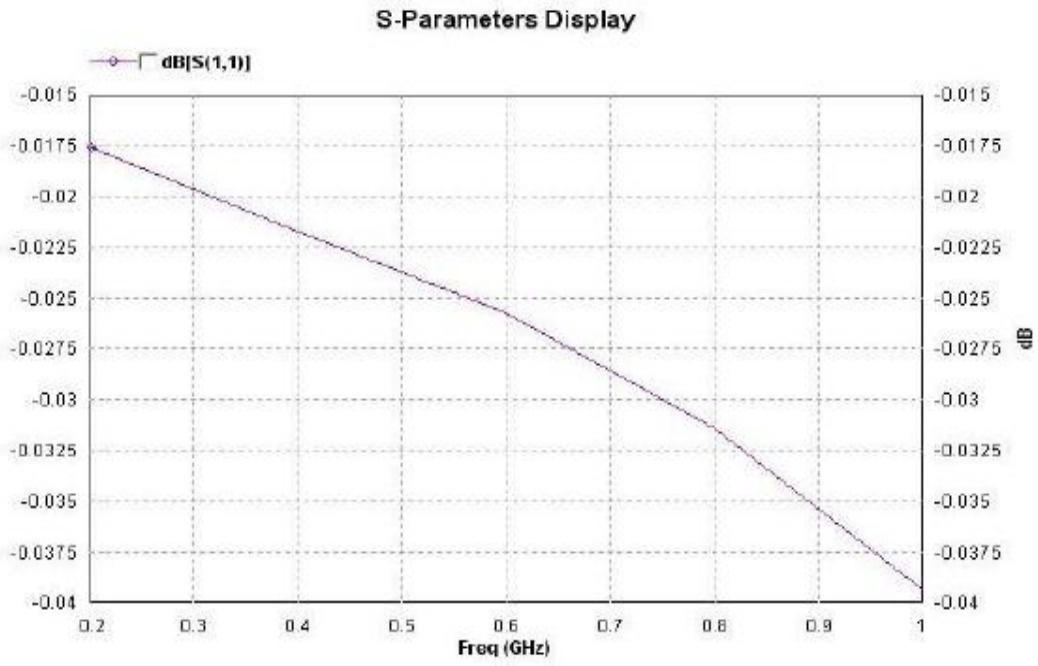

Figure15. S- Parameter curve.

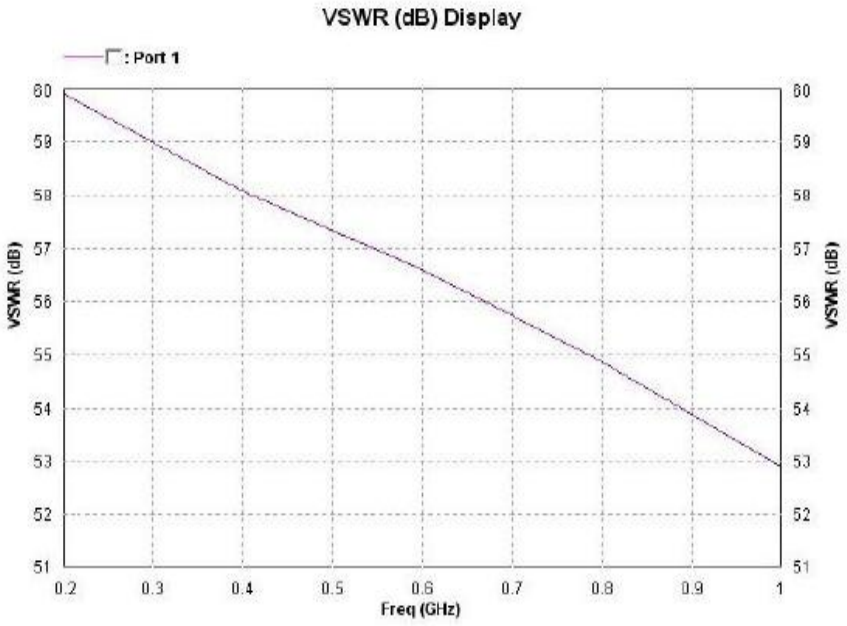

Figure 16. VSWR Curve

V. Conclusion

Based on the theoretical, simulated and analysis of the microstrip antenna, we have discussed the size and design parameters. Then we simulated the antennas that can run at 2.5 GHz frequency and calculated its reflection coefficient S_{11} by using IE3D based on Method of Moment. Through theoretical and simulated analysis, we observe the bandwidth increases when resonance frequency is greater than working frequency.

VI. Acknowledgment

We would like to thanks Dr.Deepak Nagaria, Department of Electronics and Communication Engineering, B.I.E.TJhansi, (U.P) India for his full support and guidance.

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You can use your own standard format also.

Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

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3. SUBMISSION OF MANUSCRIPTS

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To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

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Based on potential and nature, the manuscript can be categorized under the following heads: Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

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The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also. Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers*:* These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)*Title* should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, *"Abstract"* (less than 150 words) containing the major results and conclusions.

(c) Up to *ten keywords*, that precisely identifies the paper's subject, purpose, and focus.

(d) An *Introduction*, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; *conclusions* should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Abstract, used in Original Papers and Reviews:

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A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

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- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the *Harvard scheme* of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

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Informal Tips for writing a Engineering Research Paper to increase readability and citation

Before start writing a good quality Engineering Research Paper, let us first understand what is Engineering Research Paper? So Engineering Research Paper is the paper which is written by professionals, engineers or scientists who are associated to the field of engineering from all over the world. If you are novel to this field then you can consult about this field from your supervisor or guide.

Techniques for writing a good quality Engineering Research Paper:

1. Choosing the topic- In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to the field of Engineering. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

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3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

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5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

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18. **Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

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22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

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25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

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- Separating a table/chart or figure - impound each figure/table to a single page
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· Keep on paying attention on the research topic of the paper

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· Present your points in sound order

· Use present tense to report well accepted

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Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

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shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

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- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
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Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

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- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

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information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

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- Explain materials individually only if the study is so complex that it saves liberty this way.
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- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.

You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.

- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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