

OPTIMIZATION OF FANWING AIRCRAFT WITH IONOCRAFT

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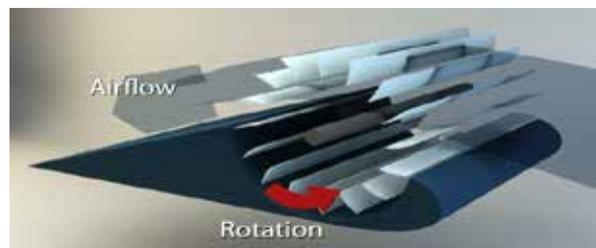
ABSTRACT

Fanwing has been affectionately described as flying lawnmowers. The similarity is because fanwing utilizes a tangential fan—that resembles a push-mower—mounted along their leading edge to artificially accelerate air rearwards over their upper camber. After a certain stage, the fan is capable of autorotation. In addition to providing lift, the fan generated a small thrust force as it accelerated air toward the trailing edge of the airfoil. The most striking result was that the fan inhibited stall at high angles of attack, increasing the maximum lift coefficient and reducing the minimum required airspeed for sustained flight by over 40%.

In our project titled OPTIMIZATION IN FANWING AIRCRAFT the modification of the FanWing concept intended for the use at higher speeds for manned flight. By adding ionocraft in the tail to tail surface of the aircraft. The lift, drag and hovering power are numerically calculated. The principle of operation, basic aerodynamic characteristics, and the features in untypical flight situation (autorotation) are described and explained.

I. INTRODUCTION

The FanWing uses a large bladed rotor lying on a horizontal axis with the front of the thick wing. This, connected to an engine, rotates, sucking in air and pushing it up and over the wing greatly increasing the lift and allowing the model he has built to carry twice its own bodyweight[1]. Thrust and lift of the vehicle, as well as steering direction, are controlled by small flaps in front of the fan which controls the angles in which the air hits the fan cages[4].



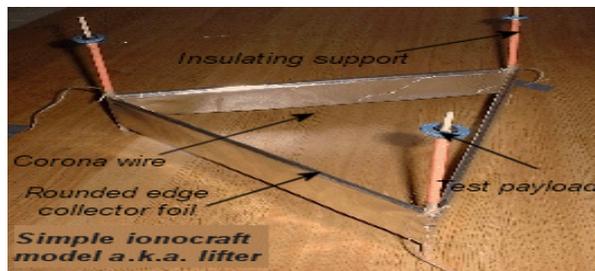
FanWing is a cyclogyro that pulls the maximal airflow through both the propulsion and lifting surfaces. A cylindrical radial turbine (resembling a cylinder mower) is embedded in the wing with its axis parallel to the wing and leaving about 2/3 of the diameter exposed above the top side of the wing's length just after the leading edge. This increases the velocity of the airflow across the wing's upper surface beyond that of the forward motion of the aircraft. Consequently the wing has lift at slow speeds where a normal wing would stall. Practical

trials with various remote-controlled models have proven that the concept provides a vehicle capable of controlled flight[7]. There are however some significant differences compared to normal fixed-wing flying The throttle directly affects the pitch which means increased throttle can slow the plane down much in the same manner a helicopter flares, and if carelessly applied can force a complete mid-air stop. Glide-ratio in case of power-failure is rather low (about 1:3) but if the power-line is disengaged, the fan-wing is fully capable of doing an auto-rotational landing[5].

II. IONOCRAFT

2.1 Introduction

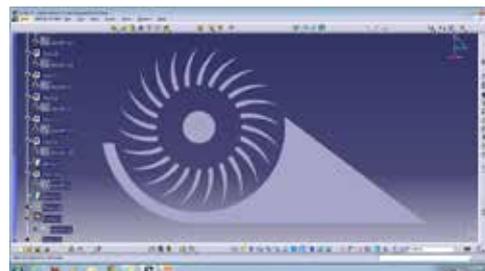
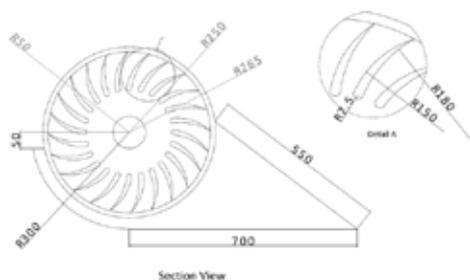
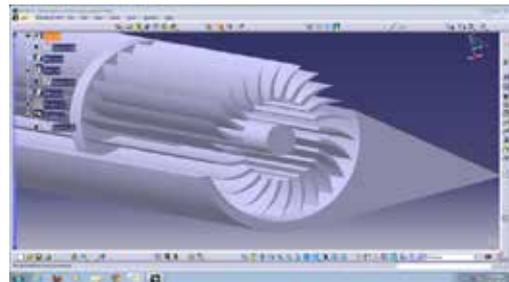
An ionocraft or ion-propelled aircraft, commonly known as a lifter or hexalifter, is an electro hydrodynamic (EHD) device (utilizing an electrical phenomenon known as the Biefeld–Brown effect) to produce thrust in the air, without requiring any combustion or moving parts.this is added in the tail to tail surface of aircraft .it is shown in the cad diagram of aircraft

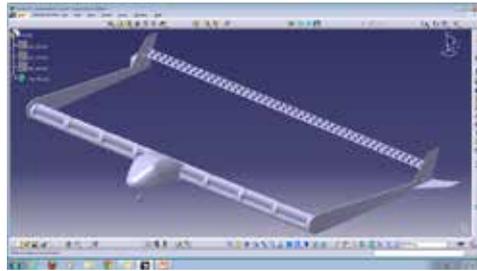


both circuit-based clients and packet-switching clients which provide a datagram service model. It can be used to carry many different kinds of traffic, including IP packets, as well as native ATM, SONET, and Ethernet frames.

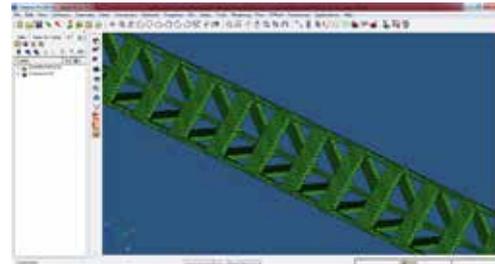
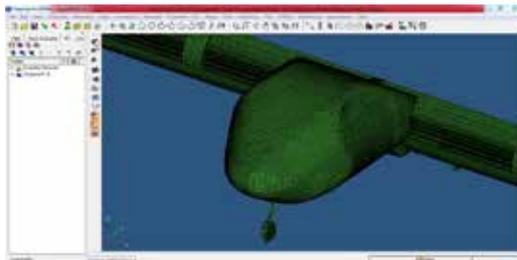
III. MODELLING

Fanwing aircraft modeled by CATIA



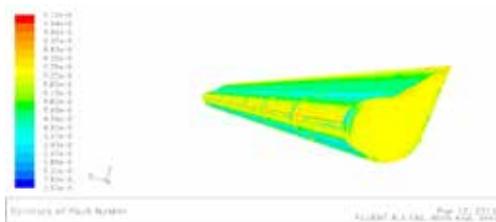


IV. MESHING OF FANWING AIRCRAFT

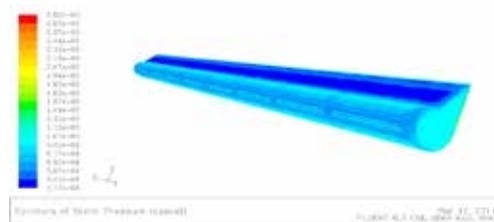


V. RESULTS

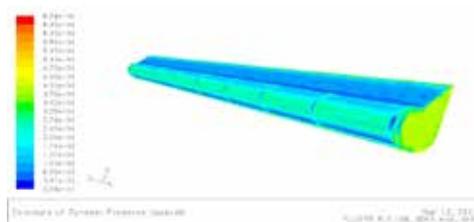
Results have been found for optimized with twisted and non twisted blade in thw combination of ioncraft which is located in the tail to tail surface of aircraft. The results are mach number and Lift and Drag are follows



Mach number



Static pressure



Dynamic Pressure

Comparison of values such as Lift(Fanwing lift+ ionocraft lift produced on tail surface) and Dynamic Pressure for untwisted and twisted aircraft

Parameters	Wing with Normal Blade	Wing with Twisted Blade	Theoretical values
Dynamic Pressure	30.8kPa	41.3kPa	37.5kPa
Lift	678.98kN	907.77kN	824.67kN

VI. CONCLUSION

This project highlights the need for implementing Fanwing Aircraft technology where the Lift is increased by adding ionocraft in the tail end of aircraft and also the modification of twisted blade give surplus amount of lift to enhance airworthy operation

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ANNEALING EFFECT AND STRUCTURAL CHARACTERIZATION OF TiO₂ THIN FILM PREPARED BY e-BEAM EVAPORATION METHOD

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ABSTRACT

TiO₂ is a cheap, non-toxic and one of the most efficient semiconductor photo catalysts for extensive environmental applications because of its strong oxidizing power and corrosion resistance. Transparent titanium dioxide (TiO₂) thin films were prepared by e-beam evaporation technique on a well-cleaned glass substrate. The pressure and deposition rate were 3.0×10^{-6} m.bar and 3 nm/s respectively. The structural characteristic of the film were analysed using GIXRD and Raman spectroscopy. The surface morphology of the film were analysed using Atomic Force Microscopy (AFM) and XRR. GIXRD studies show the as-deposited films to be amorphous and an increase in crystalline of the film was observed with increase in annealing temperature. The anatase phase of the TiO₂ film was confirmed from the GIXRD and Raman data.

Keywords : Anatase, Thinfilm, GIXRD, XRR, Raman spectroscopy, AFM.

I INTRODUCTION

Titanium Dioxide (TiO₂) is reported to have unique and important properties by various researchers. It finds applications in photocatalysis, for optical coating, as gas sensors, humidity sensors, in transparent electronic and as an dielectric material [1-8]. The optical, structural and electrical properties are found to depend on the fabrication technique used and growth conditions. There are numerous techniques available to fabricate TiO₂ thin films like electron beam evaporation, sputtering, pulse laser deposition, sol gel and spin coating. [9 – 15]. In present work, we report on the effect of annealing temperature on the structure and surface of the as prepared TiO₂ thin films prepared by e-beam evaporation method.

II EXPERIMENTAL

The films under study have been evaporated by e-gun at 8kW in a high vacuum chamber at a pressure of 3.0×10^{-6} m.bar . Commercial materials of TiO₂ (pallate) were used as original materials. The TiO₂ (99.99%) powder was compressed into a pellet form by applying pressure about 7.5 tons/cm² (747 MPa) using a hydraulic press and annealed at 500 °C for 10 hours. The substrate used were normal glass plate. The deposition rate and substrate temperature were monitored by a quartz crystal oscillator and thermocouple placed on the

substrate holder. The thickness of the prepared film was ~80 nm. Post- annealing of thin films were done in a muffle furnace in a normal air atmosphere at 500 °C for 1 hour. The crystallinity of the films was analysed using Grazing Incident X-Ray diffraction (GIXRD) using CuK α radiation.

III RESULT AND DISCUSSION

3.1 GIXRD and XRR Analysis

Normal XRD to analyse the structure of the fabricated films was not possible due to small thickness of the film. GIXRD patterns of the as deposited films are shown in fig. 1. GIXRD patterns of the films without annealing shows amorphous nature. The amorphous nature of the as deposited films is due to the slow surface diffusion of the particles with low energy. The GIXRD patterns of the post annealed films shows the transformation of the films from amorphous to a crystalline structure. The post annealed films of TiO₂ exhibits the anatase phase with preferential growth along (101) plane. The obtained pattern matches with JCPDS data card (21-1272). The crystalline size estimated using Debye Scherrer's formula shows 37 nm for the (101) plane.

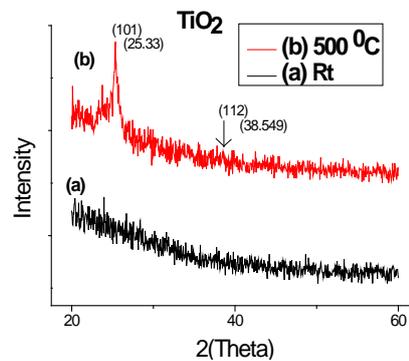


Fig. 1 : GIXRD data of the TiO₂ films.

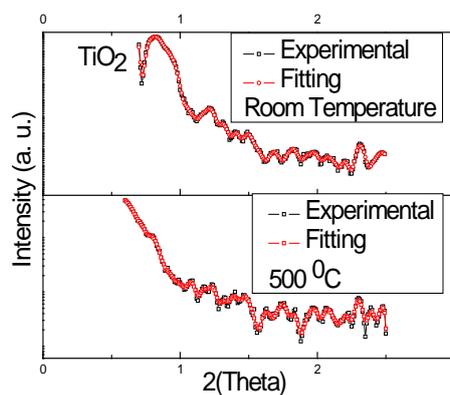


Fig. 2 (a): XRR data of the TiO₂ thin film prepared by e-beam technique.

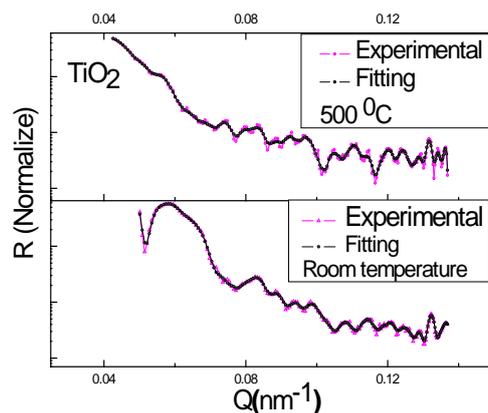


Fig. 2 (b): XRR fitting of the TiO₂ thin film prepared by e-beam technique

Since technological applications of thin films require films of definite thickness and surface morphology we used the XRR technique [16] for studying the surface property of the prepared film. From figure 2(a) and 2(b) it is clearly observed that annealed films shows a more smooth surface as compared to those which were not without annealed.

3.2 Raman Spectroscopy

The scans were taken in the range of 100 to 200 cm⁻¹. The main peak of anatase phase of TiO₂ is observed near about 144 cm⁻¹. The Raman spectroscopy of the samples confirms the anatase phase of TiO₂ as determined by GIXRD analysis.

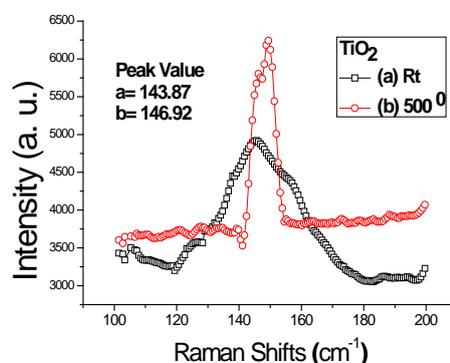


Fig. 3, Raman spectra of TiO₂ thin film prepared by e-beam technique.

Obtained Raman spectra shows a broad spectra for the non-annealed film and a narrow peak is observed in the annealed film. A small shift is also observed in the peak for the annealed film which indicates change in the structural parameters of the film. The film which was annealed shows a Raman peak at 143.87 cm⁻¹ and the annealed film shows a Raman peak at 146.92 cm⁻¹.

3.3 Atomic Force Microscopy

The AFM images for the films are shown in Fig.4(a) and 4(b). Both images shows roughness at the surface, but more homogeneity is seen in the case of annealed film. The 2D images for both films shows the spherical shape of the particles but the particle size is found to be small and of uniformly spherical shape for the annealed film.. The particle size calculated from the AFM data is ~115 nm for the annealed films. AFM images obtained on

different regions of the samples showed that the films exhibit a homogeneous globular structure. The entire film surface is formed by small grains of the deposited material. The AFM result suggests that the surface morphology of the film depends on annealing temperature of the film.

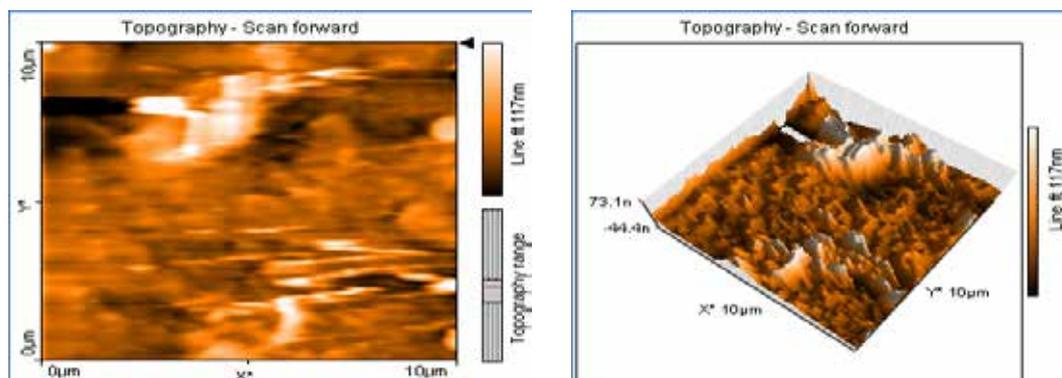


Fig. 4 (a), AFM data of the TiO₂ films (without annealed)

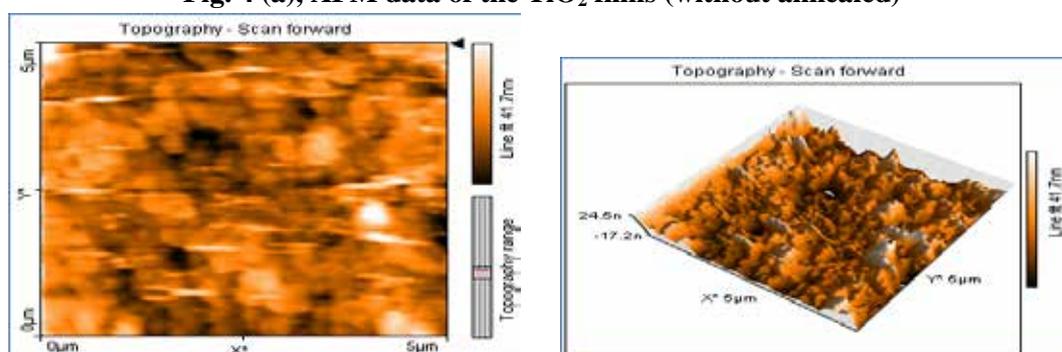


Fig. 4 (b), AFM data of the TiO₂ films annealed at 500°C

III CONCLUSION

Thin films are smooth and highly transparent. Thin films shows the amorphous nature at room temperature (without annealed film) and post annealed film shows that the crystallinity of the films increases for the anatase phase of TiO₂. XRR study also suggests that the post annealed films has surface morphology which is more smooth as compared to without annealed films. Raman data suggests that the anatase phase is present in the prepared TiO₂ film. AFM study suggests that the smoothness of the film increases with increase in calcination temperature.

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A STUDY OF QUICK SERVICE RESTAURANTS WITH REFERENCE TO CONSUMERS' PERCEPTION AND THEIR BEHAVIOR IN DELHI NCR REGION

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ABSTRACT

Quick service restaurants mean restaurants that offer fast, efficient, take-out ready foods at reasonable prices. The size of organized Indian QSR market is \$.62 bn, and is expected to reach at \$ 1.1 bn by 2017-18. Because of high population & large proportion of youth in total population number of opportunities in India for QSR are abound. But having opportunities in not enough; they have to convert them into profitable business. Keeping in view the Indian habits and changing preferences towards food consumption, Main purpose of this study is to understand the industry, identify the critical factors that can affect frequency of customer's visit to QSRs. This study is based on data collected through questionnaire and analysis has been done by using SPSS tool. This study will help the key QSRs what they should do to get more customers and to enhance customer's loyalty.

Keywords: *Consumers, Customer's Behavior, Frequency of Visit, Quick Service Restaurants*

I INTRODUCTION

At a time when the economy is experiencing a slowdown and many sectors are struggling to grow, one sector that has grown rapidly is organised fast food outlets (quick service restaurants). Entire Indian food market can be categorized into two parts: Organized & Unorganized Restaurant market. The unorganized restaurant market includes the roadside vendors, Dhabas, vans etc. The organized restaurant market includes the Quick Service Restaurants (QSR), the full service restaurants, Pubs, Bars, Clubs and Lounges and the food courts and kiosks. The QSR market will double to around Rs 70 billion in 2015-16 from Rs 34 billion in 2012-13, driven largely by new store additions. In such an opportunistic environment, how much benefits a particular QSR can avail; it depends upon their own marketing strategies, how much they understand customers and their taste and preferences. Quick service restaurants are also named as fast food restaurants. Fast food means reasonably priced and readily available food that is generally high in calories, fat, salt and sugar. And one of the key factors resulting into restaurant growth is experimentation with new formats, themes and menus by innovative & entrepreneurial ventures according to the association.

QSR industry is one of the key segments of Indian food service market and is growing very fast. Major reasons of its growth are:

- Younger workforce
- Changing lifestyle
- Craving in Indians for international food
- New Themes and menus by innovative & entrepreneurial ventures
- Increased working women

Its business comes from mainly metros & mini metros because of consumer's awareness about them, changed life style. Although it has started generating business from rural market because of improved road connectivity, urbanization.

II LITERATURE REVIEW

Ali et al. (2010) found that improving customer relationship could provide an edge for fast food retailers in India provided they are able to manage and formulate new marketing tools and practice to facilitate greater customer satisfaction and better overall experience.

Kotler (2009) Stated that core purpose of any fast food retailer must be related to providing value for money to its customers and employ advanced marketing & communication channels to strengthen the overall marketing campaign.

Goyal & Singh (2007) have culminated that the young customers visit fast food channels for fun and change.

In data monitor's (2005) survey fast food market is defined as sale of food & drinks for immediate consumption either on the premises or on designated areas shared with other food service operators or for consumption elsewhere.

Gupta (2003) found that customer perception, taste & satisfaction develop more favourable consumer behavior towards particular brand than any other factor.

United nation economic and social commission for Asia predicted that by 2020 50% of total population would be urban; half of that population would be from Asia. So fast food companies have been taking it as an opportunity to serve to Asian countries like India, Pakistan.

"Food in globalized world" has concluded that food is a means of life but it has become meaningful investment for business (Ragavan2003).

III OBJECTIVES OF STUDY

- 1) To understand QSR industry and the key players working in it.
- 2) To understand consumer's behavior towards QSR.
- 3) To analyze the factors affecting frequency of customers' visit to QSRs.
- 4) To understand the consumer perception towards different players in QSR industry.

IV HYPOTHESIS OF STUDY

- 1) There exist a significant relationship between income of a person and frequency of visit to QSRs
- 2) There exist a significant relationship between marital status of a person and frequency of visit to QSRs
- 3) There exist a significant relationship between occupation of a person and frequency of visit to QSRs

V RESEARCH METHODOLOGY

This study is descriptive in nature. Non probability sampling has been used. Data has been collected from both the methods- primary & secondary. Primary source that I have used is questionnaire. Both open ended and close ended questions have been the part of questionnaire. Secondary sources were online articles, online journals or internet primarily. Sapling area is Delhi NCR. Sample size is 100. Out of the total respondents 54 were unmarried and 46 were married. 61 % of the total were male and rest were female. The data was analyzed by using SPSS 19 version, the test applied was Correlation Pearson's Product.

VI DATA ANALYSIS

The Quick Service Restaurants (QSR) and the casual dining restaurants account for a major share of the revenues of the organized chain market in India. The QSR's and the casual dining restaurants together contributed a market share of 80.6% in FY'2013 to the organized restaurant chain market.

Many of the global players in the QSR industry such as CCD, Dominos, Pizza hut, Mc Donald's and KFC have expanded their reach to the small cities in India. Apart from the global players, many of the domestic players like Nirula's, Haldiramand Kaati Zone have also attracted the people in India by offering quick service at reasonable prices.

What they are doing to attract customers

- Adaptation according to taste of Indians
- Reasonable prices
- High promotion
- Convenient location
- Fast delivery of ordered items

Few examples of how QSRs are running successfully in India and what strategies they have adopted for it are as follows

- To attract Indian consumers, operators of multinational brands such as McDonald's, KFC and Subway have changed their food offerings, particularly increasing the vegetarian options. This is mainly because India has a huge population of vegetarians. The first vegetarian McDonald's has been opened in 2013 in northern India near the famous Golden Temple in Amritsar.

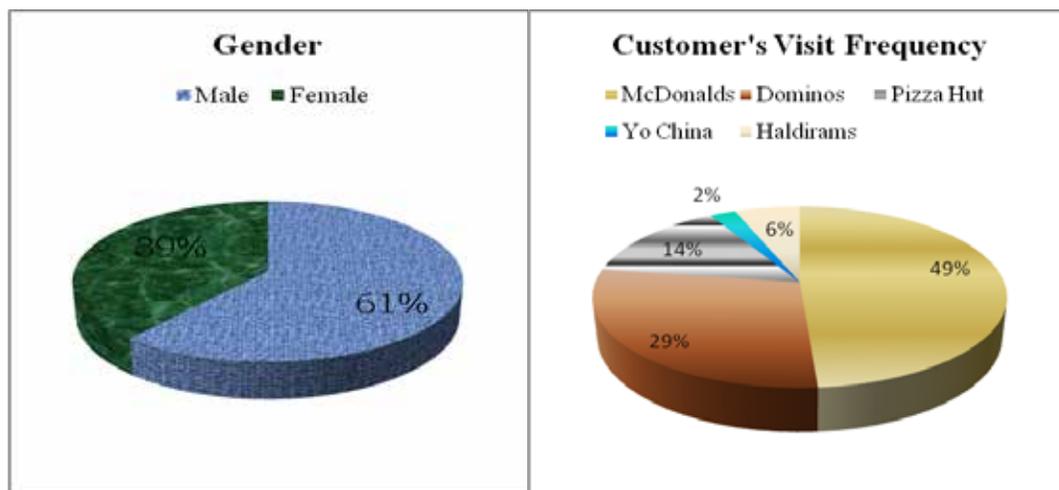
- Yum! Brands Inc, GBO of KFC, is following the same strategy, increased its vegetarian offerings in 2013. Multinational fast food brands have adapted their Indian menus to cater to local tastes, with plenty of spice and vegetarian options.
- Subway (GBO: Doctor's Associates Inc) has also taken this trend to the next level, introducing sandwiches that target the country's Jains community.

To do the research the questionnaire has been given to 100 respondents:

Gender	Number of Respondents
Male	61
Female	39

Frequency of visit to fast food outlets by consumers

Frequency of visit	Number of Respondents
Once a Week	50
Twice a Week	18
Thrice a Week	4
Once in 15 days	20
Once in Month	8



Factors effecting frequency of visit of customers to QSRs:

1) Income level of a household vs frequency of visiting QSR

Symmetric Measures

Null Hypotheses: There exists no association between income level of a household or a person and the frequency of visiting QSR

Alternate Hypotheses: There exists an association between income level of a household or a person and the frequency of visiting QSR

P (Level of significance) = 0.05

Data Analysis

On running a Chi-Square test we get the following table.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	288.104 ^a	16	.000
Likelihood Ratio	311.697	16	.000
Linear-by-Linear Association	150.488	1	.000
N of Valid Cases	209		

From the table we see that:-

- Pearson Chi Square – 288.104
- Degrees of freedom – 16
- Sig value – 0.00

We know that the sig value (0.000) is less than p value (0.05), the null hypotheses can be rejected.

The chi square tabular value for df=16 and sig=0.05 is 26.296. our chi square value (288.104) is greater than the tabulated value(26.296).

Thus it can be inferred that there exists a significant association between income level of a household or a person and the frequency of visiting QSR.

The above table depicts only the presence of association between the two variables. However, does not tell the strength of the same. This can be obtained from Cramer's V.

	Value	Approx. Sig.
Nominal by Nominal	Phi	1.174
	Cramer's V	.587
	Contingency Coefficient	.761
N of Valid Cases		.000
		209

The Cramer's V value is 0.587 which is significant. Thus we are able to say that the strength of association between income level of a household or a person and the frequency of visiting QSR is good.

2) Marital status vs. Frequency of visiting QSR

Null Hypotheses: There exists no association between marital status of a person and the frequency of visiting QSR

Alternate Hypotheses: There exists an association between marital status of a person and the frequency of visiting QSR

P (Level of significance) = 0.05

Data Analysis

On running a Chi-Square test we get the following table.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	140.884 ^a	4	.000
Likelihood Ratio	194.625	4	.000
Linear-by-Linear Association	126.495	1	.000
N of Valid Cases	209		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 14.85.

From the table we see that:-

- Pearson Chi Square – 140.884
- Degrees of freedom – 4
- Sig value – 0.00

We know that the sig value (0.000) is less than p value (0.05), the null hypotheses can be rejected.

The chi square tabular value for df=4 and sig=0.05 is 9.488. Our chi square value (140.884) is greater than the tabulated value (9.488).

Thus it can be inferred that there exists a significant association between marital status of a person and the frequency of visiting QSR.

The above table depicts only the presence of association between the two variables. However, does not tell the strength of the same. This can be obtained from Cramer's V

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.821	.000
	Cramer's V	.821	.000
	Contingency Coefficient	.635	.000
N of Valid Cases		209	

- a. Not assuming the null hypothesis.
- b. Using the asymptotic standard error assuming the null hypothesis.

The Cramer's V value is 0.821 which is significant. Thus we are able to say that the strength of association between marital status of a household or a person and the frequency of visiting QSR is very good.

3) Occupation vs Frequency of visiting QSR

Null Hypotheses: There exists no association between occupation of a person and the frequency of visiting QSR

Alternate Hypotheses: There exists an association between occupation of a person and the frequency of visiting QSR

P (Level of significance) = 0.05

Data Analysis

On running a Chi-Square test we get the following table.

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.087 ^a	16	.018
Likelihood Ratio	33.306	16	.007
Linear-by-Linear Association	.708	1	.400
N of Valid Cases		209	

From the table we see that:-

- Pearson Chi Square – 30.087
- Degrees of freedom – 16
- Sig value – 0.018

We know that the sig value (0.018) is less than p value (0.05), the null hypotheses can be rejected. The chi square tabular value for df=16 and sig=0.05 is 26.296. Our chi square value (30.087) is greater than the tabulated value (26.296).

Thus it can be inferred that there exists a significant association between occupation of a person and the frequency of visiting QSR.

The above table depicts only the presence of association between the two variables. However, does not tell the strength of the same. This can be obtained from Cramer’s V

Symmetric Measures

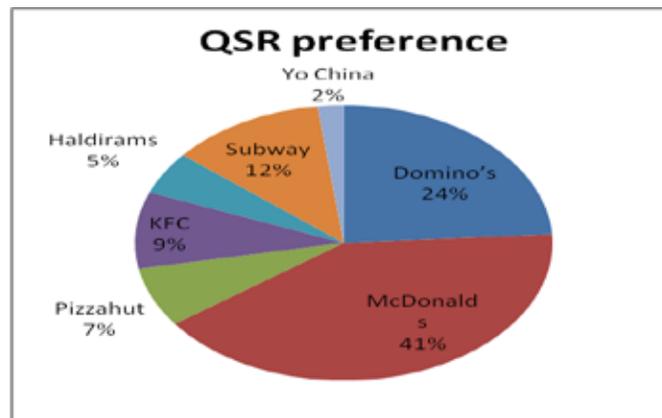
	Value	Approx. Sig.
Nominal by Nominal	Phi	.379
	Cramer's V	.190
	Contingency Coefficient	.355
N of Valid Cases		209

- a. Not assuming the null hypothesis.
- b. Using the asymptotic standard error assuming the null hypothesis.

The Cramer’s V value is 0.190 which is significant. Thus we are able to say that the strength of association between marital status of a household or a person and the frequency of visiting QSR is moderate i.e. occupation moderately shows the preference towards QSR.

The most preferred QSR

We see that McDonald’s is the most preferred QSR with 41% of respondents choosing it. It is then followed by Domino’s with 24% of the people choosing it



Thus we see that people prefer burgers over pizzas in Delhi NCR .

VII CONCLUSION

In nut shell it can be said that there are certain factors that can affect frequency of customer’s visit to QSRs so QSRs has to keep these factors in mind whenever targeting customers and design strategies accordingly. Based upon the

survey what I can say is that more and more acceptability of fast food outlets, change in life style, competition among fast food outlets with respect to quality and services to customers will be more prominent in days to come. This paper will be a help for QSRs operating in Delhi NCR mainly to understand customers, their behavior and their perception. So actually there are huge opportunities available for QSRs, what the requirement is ? it is just to understand their own mission/goals, what consumers are looking for and what is their preference and then target them accordingly to win customers' heart.

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A CONCEPTUAL FRAMEWORK ON CRITICAL SUCCESS FACTOR FOR IMPLEMENTATION OF PUBLIC PRIVATE PARTNERSHIP (PPP) BASED ON LITERATURE REVIEW

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ABSTRACT

With the swift progress of the Indian economy, the unceasing demand for all round development has created log-jams in the country's development. Investment could not be funded entirely by the government only. As an outcome, public-private partnership (PPP) could be well thought-out as a favourable option to help provide these unceasing demanded public works and services. In order to explore the potential for implementing PPPs, this paper tries to scan the extant literature to find out the critical success factors (CSFs) necessary to implement PPP projects. The objective being development of a conceptual model of determinants of PPP based on literature review. The paper identifies twenty variables grouped into five underlying factors including: favourable economic condition; project implementability; effective procurement; stable political and social environment; and government control as CSF for PPP.

Keywords: *Critical Success Factor, Determinants, Project Implementability, Project Procurement, Public Private Partnership.*

I. INTRODUCTION

In a competitive atmosphere, governments around the world are concentrating on new ways to finance projects, building infrastructure and deliver services. Public-Private Partnerships (PPP's or P3's) seems to be an instrument to bring together the strengths of both sectors. In order to maximize efficiency and innovation of private enterprise, PPPs can provide desired capital to finance government programs and projects, thereby releasing public funds for core economic and social programs.

The Finance Ministry has ensured a sharp increase in institutional funding to Public Private Partnership (PPP) Project refinance: to evolve a takeout financing scheme in consultation with banks to ensure greater funds to the infrastructure sectors (*Press Information Bureau, 2014*). For all such PPP projects, the State Governments have chalked out a well-defined regulatory framework. It comprises enactment of legislations for clearly defining the types of infrastructure facilities, the governing authorities, the procedural requirements and the scope of private

sector in implementation of these projects. The PPP also plays role in e-Governance for long-term bond between public contracting authority and private provider for delivery of quantified outputs (typically combining investment and service provision). Electronic processing permits easy hand shake amongst partners and different models outsourcing discreet tasks. The Best-practice technologies and innovation can make PPP into fruitful infrastructure project for a developing country like India.

The private sector contribution is anticipated to be about 40 billion USD and of which 10 billion dollar is expected from the foreign investors (*OECD, 2013*). Urging the foreign investors to come forward and avail the massive investment opportunities in the country. With the contemporary successes with the PPP model in the United Kingdom, Hong Kong, Singapore, Australia and other countries, PPP has become progressively more common in India. This paper emphasizes on the results obtained from a recent survey conducted by Rajkumar et al. (2013) of PPP projects in India regarding the factors that are considered critical to the realization of PPP project execution. In spite of incredible growth of PPP implementation in India, the PPP models have been repetitively reviewed and revised by the Indian government to improve the current practice of PPP implementation to ensure the accomplishment of its definite objective. Hence, this paper focuses on the critical success factors (CSFs) for successful implementation of PPP projects in India.

II. PERSPECTIVES OF PUBLIC PRIVATE PARTNERSHIP

The term ‘public–private partnership’ (PPP or P3) has been in general use since 1990s, yet there is no widely agreed single definition or model of a PPP (Bernardino et al., 2010; OECD, 2010; The World Bank, 2006). Broadly it is a long term partnership between public and private sector for provisioning of public assets/services with substantial risk shared by the private party.

PPPs can also be defined as cooperative institutional arrangements between public and private agencies. Such arrangements have gained widespread attention all over the world (Hodge and Greve, 2007b). Public-private partnerships can combine the strengths of private actors, such as innovation, technical knowledge and skills, managerial efficiency and entrepreneurial spirit, and the role of public accountability and local knowledge, to create an enabling environment for delivering high quality infrastructure and services (Roehrich et al., 2014). It also refers to as long-term participation between government and the private sector for the provision of infrastructure and public services (Harris, 2004). Thus, researches explain such a relationship as a prominent way where players from government agencies and from private agencies endeavour to achieve common objectives and share risks and profits over an extended period of time (Greve and Hodge, 2012). Babatunde et al. (2012) and Harris (2004) have indicated that financial resources are considered as one of the most important factors which help to ensure the success of PPPs. While some scholars consider PPPs to be the best tool for governments to engage with private organizations to deliver public services.

PPPs are a globally-accepted mechanism whereby government organizations utilize the skills and resources of the private sector, and shift responsibility for providing public services to private entities (Ismail, 2013). The Canadian Council for Public-Private Partnerships defines PPPs as a cooperative venture between the public and private sectors, built on the expertise of each partner that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards (Council, 2003).

Brown et al. (2006) stated that PPPs is a new model in development thinking that encompasses collaborative working arrangements between public authorities and the private sector in order to provide public services. There has been keenness on the part of scholars world-wide to identify the factors that affect the adoption of the PPPs.

III. CRITICAL SUCCESS FACTORS (CSFS) IN PPP IMPLEMENTATION

The concept of 'Critical Success Factors' (CSFs) was first introduced by Rockart and the Sloan School of Management (Jefferies et al., 2002; Hardcastle et al., 2005). Rockart (1982) defined CSFs as 'those few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his or her own goals'. Critical success elements are significantly important to help firms or organizations to identify key factors that firms should focus on in order to be successful in a project (Rowlinson, 1999). In terms of CSFs of PPP projects, studies have emerged since the 1990s. In general, there are two types of literature on the CSFs of PPP: (I) studies that evaluate the CSF of PPP projects in general and (II) studies that assess the CSFs of a specific PPP project. The present paper aims to identify determinants for success of PPP in general. However, it is intended to establish CSF's of Public Private Partnership in a particular industry/sector empirically.

The study adopted, 18 critical success factors (CSFs) developed by Li (2003). In addition to that two more factors such as sustainable procurement & operation and involvement of civil society have been added by the authors. The CSFs now comprises 20 factors that contribute to the success of Public-Private Partnership (PPP) projects. These twenty CSFs have been grouped into five broad categories as under:-

- a) Favourable economic condition;
- b) Project implementability;
- c) Effective procurement;
- d) Stable political and social environment; and
- e) Government Control.

The meanings of the five underlying grouped CSFs are:-

3.1. Favourable economic condition

Favourable economic condition consists of six critical success factors including: (i) sound economic policy; (ii) favourable legal framework; (iii) stable macroeconomic condition; (iv) appropriate risk allocation and risk sharing; (v) available financial market; and (vi) multi benefit objectives. These CSFs are all related to certifying a positive economic condition. The CSFs under this group includes policy issues, legislation, risk allocation, economics, and added value for adopting PPP.

The first CSF in this group is sound economic policy. For projects where the foremost source of revenue to the private sector is created from direct tariffs imposed on users. There are revenue risks that can go away from the control of private sector such as, future usage level and permitted tariff charges. There may also be unpredicted risks during the implementation of project life. To safeguard project economic feasibility, the government may ponder some forms of government guarantees, joint investment funding, or supplemental periodic service payments to permit the private sector cover the project costs and earn judicious profits and investment returns.

At the same time, the government should take due consideration of private sector's profitability requirements in order to have stable arrangements in PPP projects (Abdul-Rashid et al. 2006; Corbett and Smith 2006; Li et al. 2005; Nijkamp et al. 2002; Qiao et al. 2001; Tam et al. 1994; Tiong 1996; Zhang 2005).

The second CSF is favourable legal framework. An autonomous, fair, and proficient legal framework is an important aspect for successful PPP project implementation. Adequate legal resources at reasonable costs should be accessible to deal with the amount of legal structuring and documentation required. A transparent and stable legal framework should help to make the contracts and agreements bankable. An adequate dispute resolution system should help to ensure stability in the PPP arrangements (United Nations Economic Commission for Europe 2007).

Third CSF is the stable macroeconomic condition. Li et al. (2005) mentioned that, for successful PPP project implementation, government must ensure that economic conditions are favourable. The fourth CSF in this group is appropriate risk allocation and risk sharing. A core principle in PPP arrangement is the allocation of risk to the party best able to manage and control it (Efficiency Unit 2003). Logically, the government would prefer to transfer risks associated with asset procurement and service delivery to the private sector participants, who are generally more efficient and experienced in managing them. But the government should be reasonable to take up risks that are out of the control of private sector participants. In all cases, the government should ensure there are measures in place to manage the risk exposure rather than leaving it open to the private sector. Likewise before committing to the projects, the private sector participants should fully understand the risks involved and should be prudent in pricing and managing the risks appropriately (Grant 1996; Qiao et al. 2001; Zhang 2005).

The fifth CSF in this group is available financial market. Many researchers (Akintoye et al. 2001; Corbett and Smith 2006; Jefferies et al. 2002; Li et al. 2005; Zhang 2005) have found that project financing is a key factor for private sector investment in public infrastructure projects. The accessibility of a well-organized and established financial market with the benefits of low financing costs and an expanded range of financial products would be an encouragement for private sector taking up PPP projects. Lastly, lower loading is associated with multi benefit objectives. Apart from direct objectives in achieving public services, a PPP needs to consider the private contractor's business objectives.

3.2. Project Implementability

Project implementability consists of four CSFs including: (i) shared authority between public and private sectors; (ii) commitment and responsibility of public and private sectors; (iii) project technical feasibility; and (iv) thorough and realistic assessment of the cost and benefits. These CSFs mainly emphasizes on the distribution of responsibilities between the main parties in a PPP project. In addition, this group also includes the CSFs which are related to the project technicality and assessment of benefits.

The first CSF in this group is shared authority between public and private sectors. It is essential that the accountabilities of each party are properly defined and shared. In order for PPPs to work there must be a partnership in place.

The second CSF in this group is commitment and responsibility of public and private sectors. As explained by Li et al. (2005), the attitude of the stakeholders in a PPP project has an influence on the quality of outputs. Thus “soft” distinct factors such as stakeholder relationships and stakeholder management must also be considered.

The next CSF in this group is project technical feasibility. Li et al. (2005) described that traditionally, technical issues are among the most important considerations in a project feasibility study. When considering PPP procurement alternatives, it is significant to evaluate the related technical complications. In general, the private contractor needs to certify that any engineering suspicions are resolved.

The last in this group is thorough and realistic assessment of the cost and benefits. For this CSF, Li et al. (2005) also explained that before a project is subjected to the procurement process, the public client should ensure that all the potential options that are beneficial to the government and end-users are considered as part of the complete project feasibility study.

3.3. Effective Procurement

Effective procurement consists of four CSFs including: (i) competitive procurement process; (ii) transparency procurement process; (iii) well-organized and committed public agency and; (iv) sustainable procurement and operation (factor introduced by author). The first factor in this group is competitive and transparent procurement process which is important in lowering the transaction costs and shortening the time in negotiation and implementing the deal. Clear project ideas and client requirements should aid to attain these in the bidding process. In most cases, competitive bidding exclusively on price may not support to secure a strong private consortium and attain value for money for the public. The government should take a long-term view in seeking the right partner (Corbett and Smith 2006; Gentry and Fernandez 1997; Jefferies et al. 2002; Jefferies 2006; Li et al. 2005; Qiao et al. 2001; Zhang 2005).

The next CSF in this group is well-organized and committed public agency. Li et al. (2005) described that effective procurement cannot be separated from the stakeholders. This supports the institutional structure for a PPP project in that policymakers, government departments, and their agency are fundamental for successful PPP implementation.

The last CSF in this group is sustainable procurement and operation which can be explain as before a project is subjected to the procurement process, it must be ensured by the competent authority that it is within ecological limits it retain the optimistic idea of progress without compromising the ability of future generations to meet their own needs.

3.4. Stable Political and Social Environment

This category consists of - (i) political support; (ii) social support; (iii) strong and good private consortium; (iv) involvement of civil society (factor introduced by author) and; (v) good governance. The CSFs in this group are associated to the support given to PPP projects and also the capability of the public and private sectors hence is related to the complete environment situation. Fruitful PPP implementation needs a stable political and social environment, which in turn relies on the stability and capability of the host government (Wong 2007). Political

and social issues that go elsewhere private sector's domain should be controlled by the government. In the affair that the private sector participants are affected, they should be satisfactorily compensated. Unstable political and social environments have led to some failed projects such as, recurrent change in the head of state of various countries resulting in the cancellation of many up-coming public infrastructure projects initially acquired under the PPP approach.

The third CSF in this group is strong and good private consortium. The government engaged in PPP projects make sure that the parties in the private sector consortium are satisfactorily skilled and economically capable of taking up the projects. This advocates that private companies should discover other participants' strengths and weaknesses and, where suitable, join together to form a consortia capable of synergizing and exploiting their individual strengths. Good relationship among partners is also critical because they all bear relevant risks and benefits from the cooperation (Abdul-Rashid et al. 2006; Birnie1999; Corbett and Smith 2006; Jefferies et al. 2002; Kanter 1999; Tam et al. 1994; Tiong 1996; Zhang 2005).

The second last CSF in this group is involvement of civil society. This can be explained as in "pre-PPP countries," PPPs are often considered as a way of privatising public services, which could explain the higher rate of negative opinions. A second explanation could be that the implementation of PPPs could have caused some perverse effects to the local population (increase of prices, low quality, etc.). A possible way to increase the positive opinions on PPPs can be to involve more actively civil society in the development and the evaluation of these projects before a project is subjected to the procurement process.

The last CSF in this group is good governance. A dedicated and conversant public client will be able to synchronize with the private parties much more effectively. The public client will also act as an observing authority to certify that the private consortium acts according to the agreement.

3.5. Government Control

This category contains one CSF - Government involvement by providing guarantee. This CSF was grouped under government control. Under PPP contracts the government should ensure that the assets are procured and services are supplied on-time with good quality and encounter the pre agreed service benchmarks or requirements throughout the life of the contract. However, the government should be less concerned with "how" these are achieved and should not impose undue restrictions and constraints on private sector participants. The government should focus on industry and service regulation; should be flexible in adopting innovations and new technology; and should provide strong support and make incentive payments to the private sector were appropriate. On the other hand, the government should retain controls in case of default and be prepared to step in and re provide the service if necessary (Abdul- Rashid et al. 2006; Corbett and Smith 2006; El-Gohary et al. 2006; Jamali 2004; Kanter 1999; Li et al. 2005; Tam et al. 1994; Tiong 1996; Zhang 2005).

IV. DISCUSSION

The paper identifies twenty factors as determinants of Public Private Partnership for its success from review of extant researches. The determinants have been grouped into five categories Favourable economic condition, Project implementability, Effective procurement, Stable political and social environment, and Government

Control. The determinants are further spread into number of variables. The summary of the determinants along with their variables and supporting literature is presented in table 1.

Table 1. Determinants of success of PPP and Literature Support

Category	Determinants	Variables	Authors
Favourable economic condition	Sound economic policy	a) Real Gross Domestic Product (GDP) b) The Unemployment Rate c) The Stock Market d) The Interest Rate	Tam et al. (1994); Tiong (1996); EIB (2000); Qiao et al. (2001); Nijkamp et al. (2002); Li et al. (2005); Zhang (2005); Abdul-Rashid et al. (2006); Corbett and Smith (2006).
	Favorable legal framework	a) Comprehensiveness of rights b) Right to develop c) Right to determine	Boyfield (1992); Stein (1995); Jones et al. (1996); Bennett (1998); United Nations Economic Commission for Europe (2007).
	Stable Macroeconomic condition	a) Return on Assets b) Return on Equity c) Equity Multiplier	Dailami and Klein (1997); Qiao et al. (2001); Li et al. (2005).
	Appropriate Risk Allocation and Risk Sharing	a) Transferred risks b) Retained Risks c) Shared Risks	Grant (1996); Arthur Andersen and Enterprise LSE (2000); Qiao et al. (2001); Zhang (2005).
	Available Financial Market	a) Exchange Rate b) Asset Prices c) Capital flows	McCarthy and Tiong (1991); Akintoye et al. (2001); Qiao et al. (2001); Jefferies et al. (2002); Li et al. (2005); Zhang (2005); Corbett and Smith (2006).
	Multi Benefit Objectives	a) Inflation Risk b) Withdrawal Risk	Grant (1996)
Project implementability	Shared Authority between Public and Private Sectors	a) Suitable Contractors b) Insurance agreement	Stonehouse et al. (1996); Kanter (1999).
	Commitment and Responsibility of Public and Private sectors	a) Transparency in operation b) Trained staff	Stonehouse et al. (1996); Kanter (1999); NAO (2001); Li et al. (2005)
	Project Technical Feasibility	a) Production Process b) Capacity and Design	Tiong (1996); Zantke and Mangels (1999); Qiao et al.

Category	Determinants	Variables	Authors
		c) Lay out d) Raw material and its sources	(2001); Liet al. (2005)
	Thorough and realistic assessment of the cost and benefits	a) Capital and recurrent costs b) Fixed and variable costs c) Performance driven benefits d) Value driven benefits	Brodie (1995); Hambros (1999); Qiao et al. (2001), Liet al. (2005)
Effective procurement	Competitive procurement process	a) Restricted tender b) Negotiated procedure c) Urgent processing d) Framework agreements	Gentry and Fernandez (1997); Kopp (1997); Arthur Andersen and Enterprise LSE (2000); Jefferies et al. (2002).
	Transparency procurement process	a) Clear and comprehensive bidding documents b) Legislative and administrative measures	Gentry and Fernandez (1997); Kopp (1997); Arthur Andersen and Enterprise LSE (2000); Qiao et al. (2001); Jefferies et al. (2002); Li et al. (2005); Zhang (2005); Corbett and Smith (2006).
	Well-organized and committed public agency	a) Turnover b) Organizational Citizenship behavior c) Job performance d) Empowerment	Boyfield (1992); Finnerty (1996); Stein (1995); Jones et al. (1996); Li et al. (2005)
	Sustainable procurement and operation	a) Environment protection expenditure as % of GDP b) Environment taxes and subsidies as % of government revenue c) Protected area as % of total land area	Authors/Experts opinion
Stable political and social environment	Political support	a) Communication b) Security c) Personnel	Zhang et al. (1998); Qiao et al. (2001); Wong (2007).
	Social support	a) Emotional Support b) Instrumental Support	Frilet (1997); (Wong 2007).
	Strong and good private consortium	a) Stable government b) Availability for fund c) Technical Solution in advance	Tam et al. (1994); Tiong (1996); Birnie (1999); Kanter (1999); Jefferies et al.

Category	Determinants	Variables	Authors
			(2002); Zhang (2005); Abdul-Rashid et al. (2006); Corbett and Smith (2006).
	Involvement of civil society	a) Campaign activities b) Co-operative activities c) Citizen initiated contacts	Authors/Experts opinion
	Good governance	a) Transparent and participative in its decision making b) Accountable for its action	Badshah (1997); Frilet (1997); Qiao et al. (2001).
Government Control	Government guarantee Stable Political and Social Environment Government Control	a) International Finance Corporation Guarantees b) World Bank Guarantees c) Multilateral Investment Guarantee Agency	Tam et al. (1994); Stonehouse et al. (1996); Tiong (1996); Zhang et al. (1998); Kanter (1999), Qiao et al. (2001); Jamali (2004); Li et al. (2005); Zhang (2005) Abdul-Rashid et al. (2006); Corbett and Smith (2006); El-Gohary et al. (2006).

As an outcome of the literature analysis a conceptual model has been developed (figure 1). The model depicts that success of PPP depends upon five core factors including favourable economic condition; project implementability; effective procurement; stable political and social environment; and government control. These factors further consist of twenty determinants which are elaborated in earlier sections. The model can be validated using statistical tools to interpret empirically collected data.

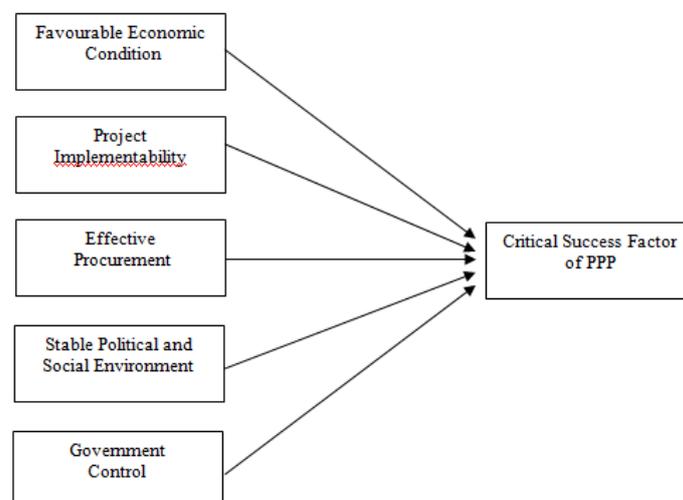


Figure1. Conceptual Model of Determinant of PPP success

V. CONCLUSION

To conclude it can be said that detailed scanning of literature has provided us with various factors responsible for success of PPP projects. For further research twenty research premises are proposed for success of PPP project. These research premises are used to develop a conceptual model as shown in Figure 1. It is proposed that this conceptual model can be tested and validated using empirical studies involving survey of critical success factors for PPP and/or case studies of successful projects. The model is likely to be a useful tool for in depth analysis and understanding of the concept of PPP. Limitation of this work is that it is exploratory in nature and is based on work done by earlier scholars and researchers. The model is conceptual in nature and has to be validated by further research.

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A NOVEL APPROACH TO PROVIDE SECURITY OVER MAILING SYSTEM USING CRYPTOGRAPHY

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ABSTRACT

Abstract- Security is the main aspect of any field, organization, company as well as to secure email data. Cryptography is one of the techniques which is used to secure the data over a network. It consists of two types asymmetric cryptography and symmetric cryptography. Using encryption and decryption algorithm we are having different types of algorithms of cryptography. Here we are proposing a cryptography algorithm which is hybrid in nature which is complex as well as cost effective. The main concern of cryptography algorithm is to secure the key, registration of client as well as proper encryption and decryption process. Here we are proposing an algorithm to provide the security over mailing system. The algorithm designed will have the following features: 1. it is cost effective in nature and provides security to email data. 2. It is hybrid in nature so it is more complex. 3. It is efficient as well as best for small organization.

Keywords: *Cryptography, Hybrid Approach, Secret Key, Encryption, Decryption, ASCII, Cipher Text, Plaintext*

I INTRODUCTION

Cryptography is a process which is associated with scrambling plaintext into cipher text (a process called encryption), then back again (known as decryption). There are several ways to classify the various algorithms. One of which is secret key cryptography, in which a single key is used for both encryption and decryption. Another one is public key cryptography or asymmetric key cryptography which involves the use of key pairs: one private key and one public key. Both are required to encrypt and decrypt a message or transmission. ^[1]

Cryptography is used to achieve few goals like Confidentiality, Data integrity, Authentication etc. of the data which has sent to the receiver from the sender. Now, in order to achieve these goals various cryptographic algorithms are developed by various people. It has been found that the algorithms which are available at this moment are more difficult or less complex in nature, and of-course it is quite obvious.

For a very minimal amount of data those algorithms wouldn't be cost effective since those are not designed for small amount of data. The aim of this work is to design and implement a new algorithm to address this issue so that we don't have to apply those algorithms (which are not cost-effective) to encrypt a small amount of data. Keeping this

goal in mind the proposed algorithm has been designed in a quite simple manner but of course not sacrificing the security issues.

II PROPOSED ALGORITHM

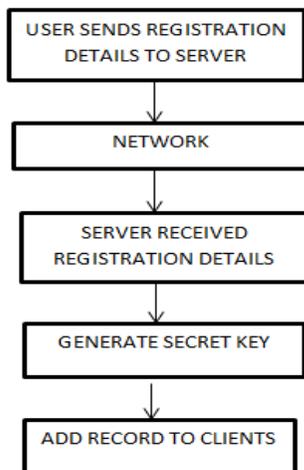
We proposed a hybrid approach of cryptography algorithm which helps in securing mailing system over a network. In this algorithm cost is main aspect which is taken care. It is cost effective in nature and very simple. The approach consists of registration of client, secret key generation, and encryption and decryption process.

There will be mail application server and mail application client is there. Here this proposed algorithm is a mixture of two algorithms which is based on ASCII based cryptography

PROTOTYPE:

ALGORITHM 1

1. User sends registration details to server.
2. It will reach to the network.
3. Server received required details.
4. Generate secret key.
5. Add record to clients.

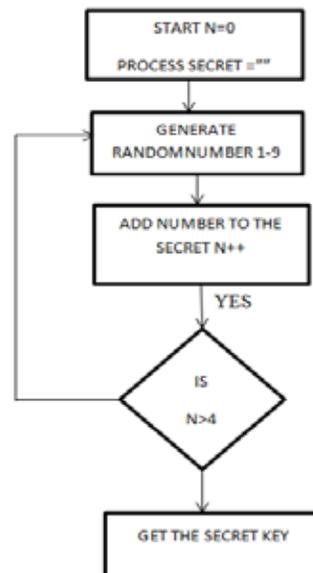


A. Flowchart for Registration of Client

ALGORITHM 2

1. Start process $n=0$ secret = "";
2. Generate random number from 1-9.
3. Add number to the secret $n++$.
4. If $n > 4$ then

5. Get the secret key otherwise
6. Go to step 2.

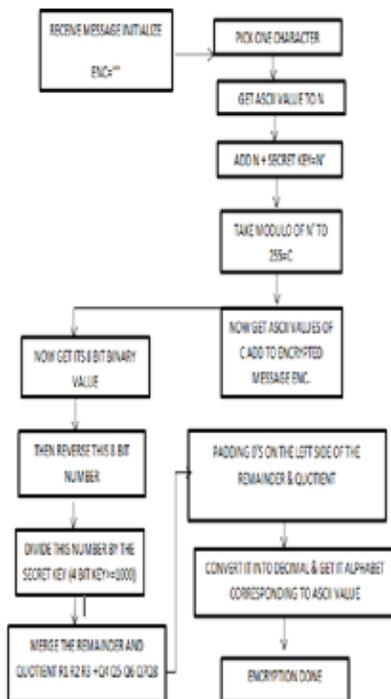


B. Flowchart for Secret Key Generation

ALGORITHM 3

1. Initialize receive message ENC="".
2. Pick one character.
3. Get ASCII value to n .
4. Add $n+$ secret key= n' .
5. Take modulo of n' to $255=c$.
6. Now get ASCII value of c add to encrypted message enc.

7. Generate the ASCII value of the alphabet.
8. Generate the corresponding binary value of it.
9. Reverse the 8 digit's binary number
10. Take a 4 digits divisor (≥ 1000) as the Key
11. Divide the reversed number with the divisor.
12. Store the remainder in first 3 digits & quotient in next 5 digits. If any of these are less than 3 and 5 digits then we need to add padding 0s (zeros) in the left hand side. Output will get.



ALGORITHM 4

1. Initialize receives message DEC=""

C. Flowchart for Encryption Process

2. Pick one character.
3. Get ASCII value to n.
4. Subtract $n - \text{secret key} = n'$.
5. Take modulo of n' to $255 = c$.
6. Now get ASCII value of c add to encrypted message enc.
7. Multiply last 5 digits of the cipher text by the Key
8. Add first 3 digits of the cipher text with the result Produced in the previous step.
9. If the result produced in the previous step i.e. step2 is not an 8-bit number we need to make it an 8-bit number.
10. Reverse the number to get the original text i.e. the plain text.



D. Flowchart for Decryption Process

III ADVANTAGES OF THE PROPOSED ALGORITHM

1. The Algorithm is very simple in nature.
2. It works best for a small organization because it is cost effective.
3. For a small amount of data this algorithm will work very smoothly.
4. This algorithm is a hybrid approach which is more complex and effective in nature.

IV IMPLEMENTATION

Here for the implementation of this algorithm Java is used. Java is a general-purpose, object-oriented language that is specifically designed so that few implementation dependencies may occur. JAVA is used mainly for client server applications. Java platform and Netbeans are used to implement the algorithm.

V CONCLUSION AND FUTURE WORK

This algorithm provides security to mailing system and its data. This algorithm will be helpful in securing the private and confidential data of email. This algorithm is hybrid in nature so it is complex and efficient. The prototype of the algorithm is difficult to decode. This is cost effective which makes it more valuable. Future work on this field is never ending till any loop hole is found in the algorithm.

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EFFECT OF CALCINATION STRATEGIES ON ACTIVITY OF Co-Mn CATALYSTS FOR SIMULTANEOUS CONTROL OF CO AND CH₄ EMISSIONS FROM CNG FUELLED VEHICLES

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ABSTRACT

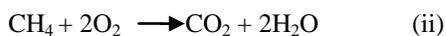
CNG fuelled vehicles are alternative for conventional engines. But these are emitting significant amount of CO and CH₄. Therefore, to reduce the emissions, this work aims to develop low cost non-noble metal catalysts for simultaneous oxidation of lean mixture of CO-CH₄. Cobalt-Manganese (molar ratio=5:1) catalyst was prepared by co-precipitation followed by calcination under three different strategies. The first strategy was reactive calcination (RC) involving feed of a low concentration of chemically reactive, 4.5% CO-air mixture over the catalyst at low temperature of 160°C in the beginning and gradually increased to 400°C. Under second strategy, the catalyst was also calcined in-situ in flowing air and finally calcined in an electric furnace around 400°C for 4 h under the third strategy. The resulting catalysts were named as Cat-1, Cat-2 and Cat-3 respectively. The catalytic performance was evaluated in a tubular flow reactor under following conditions: Wt. of catalyst=500mg, flow rates of CO and CH₄ =1.5 ml/min each and air flow rate=97 ml/min. The Cat-1 showed total oxidation of lean mixture of CO-CH₄ at much lower temperature (340°C) in comparison to Cat-2 (380°C) and Cat-3 (400°C) and activity order of the catalysts for CO-CH₄ oxidation was as follows: Cat-1 > Cat-2 > Cat-3.

Keywords: Co-Mn catalysts, Reactive calcination, CO-CH₄emissions, CNG Vehicle, Pollution control

I INTRODUCTION

Compressed natural gas (CNG) vehicles are considered to be one of the most promising alternatives of conventional vehicles due to soar in petroleum prices and increasing strict emissions limit (Li et al, 2009). CNG fuel contains 92.6% methane (CH₄), 5.8% ethane (C₂H₆), 1.2% CO₂ and rest other gases (Cho and He, 2009). Therefore, CNG vehicles have much lower emissions of toxic higher hydrocarbon (HC), nitrogen oxides (NO_x) and particulate matter (PM) compared to conventional gasoline and diesel engines (Tang et al, 2009). Unfortunately, the emissions from CNG vehicles have high concentration of CH₄ and low concentration of carbon-monoxide (CO). CH₄ is a powerful greenhouse gas (GHG), which has approximately 20 times the warming potential of CO₂ (Cho and He,

2009). CO and CH₄ being harmful gases also have adverse impact on human health and climate change. A number of methods are employed to control CO-CH₄ emissions, although amongst them, catalytic oxidation using three way catalytic (TWC) converters are recognized as one of the most efficient technique. The important role of automotive catalyst consisting of noble metals (Pt, Pd) are used to completely oxidize these pollutants to non-toxic atmospheric gases like CO₂ and H₂O vapor according to the following chemical reactions:



The problem of TWC is that it shows very less activity during cold start condition and the self-poisoning of Pt by CO at low temperatures. Further, the high cost and scarcity of noble metals have long been motivated the search for low cost, highly active and sturdy substitute to control CO and CH₄ emissions (Liu & Stephanopoulos, 1995). Therefore, a variety of transition metals based non-noble metal catalyst such as Mn, Cu, Cr, Fe, Co become appealing due to lower cost and relative plentiful resources (Li et al, 2009). Among all the transition metal oxides, Co₃O₄ is believed to be a good CO-CH₄ combustion candidate (Xianglan et al, 2014). TANG et al. (2009) studied the combustion of CH₄ over Co₃O₄-SnO₂ catalyst and found that Co₃O₄ was the active species, SnO₂ acted as a support or a promoting component in the Co₃O₄-SnO₂ hybrid oxides. Trigueiro et al. (2006) have studied the effect of niobium addition to Co/γAl₂O₃ and found that both cobalt-containing catalysts (4.5 and 9.3%, by weight, of Co) show a higher catalytic activity when compared to cobalt-containing niobia-alumina catalyst (6.3%, by weight, of Co). On the other hand, platinum and manganese oxide catalysts (Barresi et al, 1992) have been applied in methane combustion. High activity of methane oxidation has also been observed on Mn-doped ZrO₂ by Choudhary et al. (2002). Li et al. (2003) have studied the catalytic combustion of methane activities of Co-Mn mixed oxide catalysts prepared by sol-gel methods. Although the promoting effects of water vapour were discovered on the Co-Mn mixed oxide catalysts, no promoting effects of manganese to the catalytic activity were found.

In the present work, Co/Mn (molar ratio=5:1) mixed catalyst was prepared by co-precipitation method. Both Co and Mn cations can attain variable oxidation states and may be the effective components in mixed-oxide-based catalysts suitable for combustion reactions. The decomposition of catalyst was carried out into three different ways: i) Reactive calcination, ii) Flowing air and iii) Conventionally stagnant air. The effect of different calcination method has been demonstrated. Reactive calcination of the catalyst was performed by reactive gas CO-Air mixture.

II EXPERIMENTAL

2.1. Catalyst preparation

The Co/Mn mixed catalysts (molar ratio=5:1) were prepared following the method described by Li and co-workers, [2009]. Co-precipitation of basic carbonates of Co and Mn was carried out by adding drop-wise ammonium bicarbonate solution into the aqueous solution of cobalt nitrate and manganese acetate. The precipitates were aged with stirring at room temperature for 8 h. They were filtered and washed thoroughly with distilled water free of anions and also with deionized water and with 80 mL ethanol until the pH reached 7.0 followed by drying at room temperature for overnight then at 90°C for 6 h in an electric oven. The calcination of the catalyst precursor was

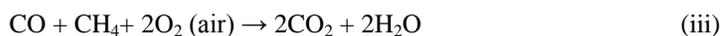
performed under three different strategies at 400 °C. Firstly, the catalyst was calcined in a specific chemically reactive, 4.5% CO-air mixture termed as reactive calcination (RC) method as described below. The catalyst thus obtained was named as Cat-1. Secondly, it was calcining in flowing air resulting Cat-2. Third strategy was conventional method; calcination was carried out in a stagnant air, producing Cat-3.

2.2. Reactive calcination

The reactive calcination of catalyst was carried out *in situ* in a compact bench scale fixed bed, down flow tubular reactor, details of the reactor is given elsewhere (Prasad and Rattan 2009). A defined amount of the catalyst precursor (equivalent to 500 mg of the calcined Co-Mn catalyst) diluted with α -alumina ($S_{\text{BET}} = 3.03 \text{ m}^2 \text{ g}^{-1}$, pore volume = 0.01 cc g^{-1}) to make a total volume of 2 ml at atmospheric pressure was taken. The reactor was placed vertically in a microprocessor temperature controlled split open furnace. The heating rate of the bed was $1 \text{ }^\circ\text{C min}^{-1}$ with a temperature control of $\pm 0.2 \text{ }^\circ\text{C}$. Reactive calcination of the precursors was carried out by the introduction of a low concentration of chemically reactive CO-air mixture (4.5% CO) at a total flow rate of 60 ml min^{-1} over the hot precursors. Digital gas flow meters were used to measure the flow rates of CO and air to feed the mixture (dried and CO_2 free) in the required proportion into the reactor. The temperature was monitored with the help of a K-type thermocouple inserted in the thermo-well of the reactor in contact with the precursor bed. The temperature of the bed was increased from room temperature to $160 \text{ }^\circ\text{C}$ where CO oxidation started and completed within few minutes with 2°C rise in temperature. After achieving total CO conversion the temperature of the resultant catalyst bed was increased to $400 \text{ }^\circ\text{C}$ and maintained for two hour under the same CO-air flowing conditions. For the comparative studies two catalysts were also prepared by usual calcination of the precursor in stagnant air as well as in flowing air at 400°C for 4h.

2.3 Catalytic activity measurement

The activity of the catalysts was measured for simultaneous oxidation of CO and CH_4 in the same reactor as used for reactive calcination of the catalyst. After RC the catalyst bed was cooled to room temperature in the same environment and oxidation of lean mixture of 1.5 % CO and 1.5% CH_4 in air was carried under the following reaction conditions: Catalyst weight 500 mg, and total gas flow rate of 100 ml/min. The reaction temperature ranged from ambient to the value when 100% CH_4 conversion was attained. Air fed was made free of moisture and CO_2 by passing it through CaO and KOH pellets drying towers. The flow rates of CO, CH_4 and air were monitored with the help of digital gas flow meters. The catalytic experiments were carried out under dynamic conditions of heating at a rate of $1^\circ\text{C}/\text{min}$. The rate of heating was controlled with the help of a micro-processor based temperature controller. The simultaneous oxidations of CO and CH_4 over the catalyst can be represented by equation (iii).



The gaseous reactants and products were analyzed by an on-line gas chromatograph (Nucon series 5765) equipped with porapack q-column, methanizer and FID detector for the concentration of CH_4 components, CO and CO_2 . The catalytic activity for the simultaneous oxidation was expressed in term of the conversion of limiting reactants such

as; CO, CH₄ and overall CO-CH₄. The fractional conversion of CO at any instant was calculated on the basis of values of the concentration of CO in the feed and product stream by the following equation 1:

$$(X_{CO})_i = [(C_{CO})_{in} - (C_{CO})_{out}] / [C_{CO}]_{in} = [(A_{CO})_{in} - (A_{CO})_{out}] / [A_{CO}]_{in} \quad (1)$$

Where, concentration of CO is proportional to the area of chromatogram of CO. Similarly, the fractional conversion of CH₄ was calculated using the following equation 2:

$$(X_{CH_4})_i = [(A_{CH_4})_{in} - (A_{CH_4})_{out}] / [(A_{CH_4})_{in}] \quad (2)$$

The change in the overall concentration of CO-CH₄ due to simultaneous oxidation at any instant is proportional to the area of chromatogram of CO₂ formed (A_{CO2})_i, and overall concentration of CO-CH₄ in the inlet stream is proportional to the area of CO₂ chromatogram (A_{CO2})_f resulting at 100% conversion of CO-CH₄ together, i.e. single peak of CO₂ in GC chromatogram. Thus the overall conversion of CO and CH₄ was calculated as per following equation 4:

$$(X_o)_i = [(A_{CO_2})_i] / (A_{CO_2})_f \quad (3)$$

III RESULT AND DISCUSSION

The GC chromatogram of a typical reactor inlet and outlet of the simultaneous oxidation of lean mixture of CO-CH₄ experiment is shown in figure 1. Only two chromatogram peaks corresponding to CO and CH₄ were recorded for inlet (Fig 1a) whereas at initiation of oxidation additional small peak of CO₂ appeared in the outlet stream of the reactor (Fig 1b).

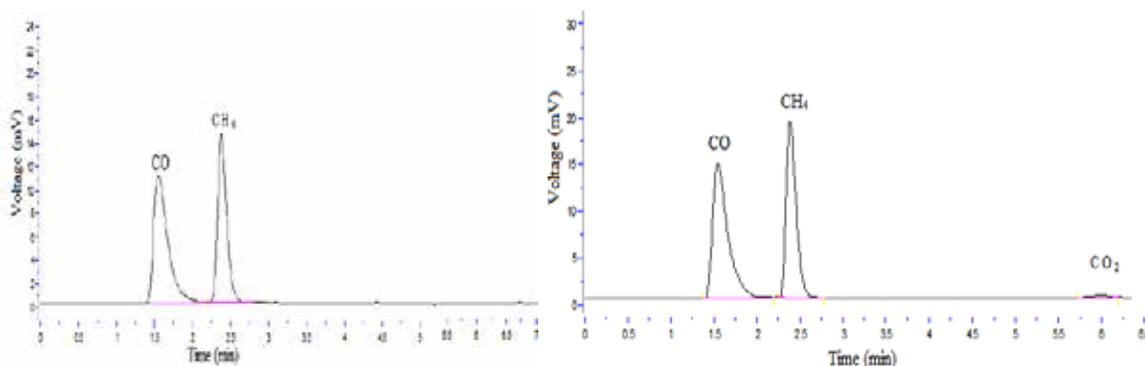


Fig. 1: GC Chromatogram of (a) reactor inlet (b) reactor outlet at initiation of oxidation

The total CO conversion occurred at lower temperature of 150°C than CH₄ which partially oxidized as shown in fig 2a depicting two peaks of unconverted CH₄ and CO₂. Fig 2b demonstrates complete oxidation of CO and CH₄ to CO₂ illustrating a single peak of CO₂ in the chromatogram.

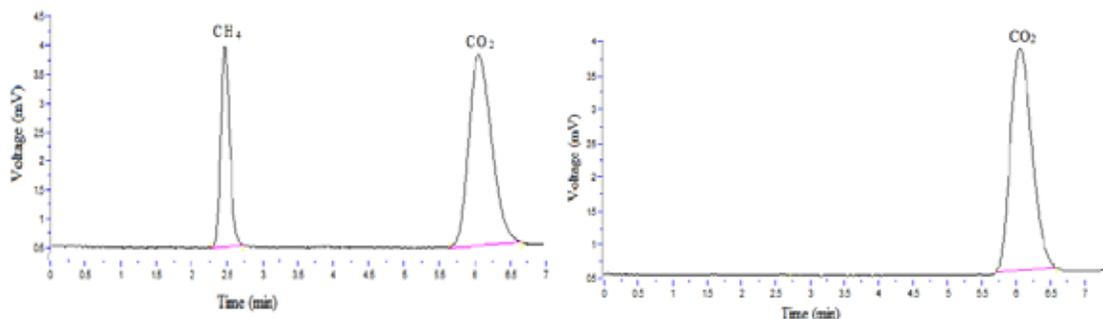


Fig. 2: GC chromatograms of reactor outlet complete oxidation of (c) CO, (d) CO-CH₄ to CO₂

3.1 Effect of Calcination Temperature

The activity tests of the catalysts were conducted in which CO and CH₄ reacted simultaneously with O₂. These tests were conducted to evaluate the catalytic activities of Co-Mn catalyst under different calcination conditions as shown in Fig. 3 (a, b). It is very clear from the Fig 3 that all the three catalysts showed conversion of CO-CH₄ to CO₂ and water at different temperatures depending on their activities upto 400 °C. From the Figs. it can be seen that CO-CH₄ conversion over the prepared catalysts continuously increasing with temperature and then rose to total conversion. Fig. 3 a shows comparison of catalytic conversion efficiencies of Co-Mn mixed oxide catalyst obtained by calcination of the catalyst under various strategies for CO oxidation in simultaneous test. Complete conversion of CO to CO₂ took place at 220 °C and 190 °C over Cat-2 and Cat-3 respectively while it was at the lowest temperature of 150 °C over Cat-1. Similarly, from Fig.3 b the temperature of total oxidation of CH₄ over Cat-1 was 340°C. While overall conversion of both CO and CH₄ were observed at higher temperatures over Cat-2 and Cat-3 as compared to Cat-1 as shown in Fig 3 as well as in table 1. Thus, the Cat-1 showed the highest activity for oxidation of CO as well as CH₄.

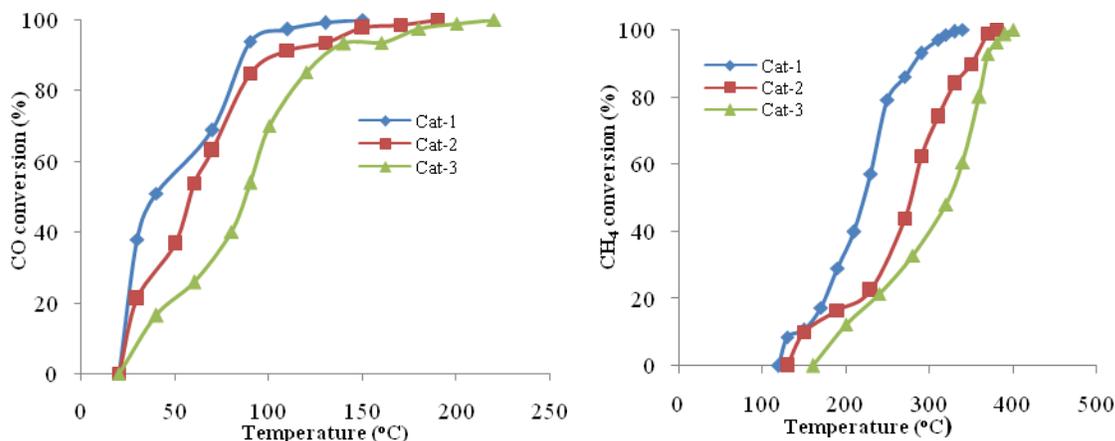


Fig. 3: Conversion of (a) CO Vs temperature (b) CH₄ Vs temperature over Cat-1, Cat-2 & Cat-3

Table. 1: Light off characteristics of catalyst for simultaneous oxidation of CO and CH₄

Components	Cat-1			Cat-2			Cat-3		
	T _i	T ₅₀	T ₁₀₀	T _i	T ₅₀	T ₁₀₀	T _i	T ₅₀	T ₁₀₀

CO	30	40	150	30	60	190	40	90	220
CH ₄	130	230	340	150	280	380	180	320	400

IV CONCLUSION

It can be concluded that Co/Mn is an excellent catalyst for simultaneous oxidation of lean mixture of CO-CH₄ at low temperature. The method of calcination of the catalyst has great influence on the activity of the resulting catalysts. The relative improvement in the performance of the catalyst for simultaneous oxidation of lean mixture of CO-CH₄ is achieved by method of calcination of the catalyst precursor in the following sequence of decreasing order: Reactive calcination > flowing air > stagnant air. Further, the catalytic activity order in the decreasing sequence is as follows: Cat-1>Cat-2>Cat-3. The extraordinary performance in CO-CH₄ oxidation of the catalyst is achieved at much lower temperature. Therefore, RC is the best calcination method in comparison to conventional methods for production of Co/Mn mixed for simultaneous complete oxidation of CO-CH₄ at low temperature.

V ACKNOWLEDGEMENT

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NOMENCLATURE

T _i	Initial combustion temperature
T ₅₀	Light off temperature
T ₁₀₀	Complete combustion temperature
X _{CO}	Carbon monoxide conversion
X _{CH₄}	Methane conversion

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Bibliographical Notes

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A SURVEY ON TEXT EXTRACTION TECHNIQUES IN COMPLEX IMAGES AND VIDEOS

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ABSTRACT

Text data present in images and videos mainly contains useful information for fully understanding it and helps for the automatic indexing, annotation and structuring of images. Extraction of this information involves several steps such as detection, localization, tracking, extraction, and recognition of the text from a given image. Text in images varies with differences in style, size, orientation, and alignment. The low image contrast and complex background makes the problem of automatic text extraction extremely challenging. A number of techniques have been proposed to solve this problem. The purpose of this paper is to classify and review these algorithms, also discuss the performance evaluation, and to point out promising directions for future research. This further open up the possibility for more improved and advanced systems.

Index Terms—Connected Component, CVPR, Edge Detection, Text Extraction

I. INTRODUCTION

In recent years, there is a drastic increase in multimedia libraries. The amount of digital multimedia data is growing exponentially with time. Number of television stations are broadcasting every day. With wide spread of affordable digital cameras and inexpensive memory devices, multimedia data is increasing every second. Ranging from cameras embedded in mobile phones to professional ones, Surveillance cameras to broadcast videos, every day images to satellite images, all these contribute to increase in multimedia data. According to Flickr statistics in 2013, 43 million images per month are uploaded that is in average 1.42 million per day [1]. And according to youtube official announcement, 72 hours of videos are uploaded to the site every minute and watched over 3 billion hours a month [2]. With this dramatic increase in multimedia data, escalating trend of internet, and amplifying use of image or video capturing devices the content based indexing and text extraction have more importance among the researchers.

Text embedded in images contains the useful semantic information regarding the image. This information can be used to fully understand images. Text within an image enables applications such as keyword-based image search, automatic video logging, and text-based image indexing. Extraction of text from images is a very difficult task due to variations in character fonts, styles, sizes and text directions, and presence of complex backgrounds and variable light conditions. Text regions may contain very useful information regarding the image.

Generally, the text present in images can be categorized into three based on the type of images: document images, scene images and born-digital images. Document images are the image-format of the document. The text present in document image is the document text. Born-digital images are the images generated by computer software and are saved as digital images. The text in these images is called as caption text or overlay text. Some researchers specify overlay text as superimposed text or artificial text. The overlay text can be seen as the text scrolling in the news channels. Scene images are the images that contain the text, such as the advertising boards, banners, which is captured naturally when the scene images are taken by the camera, therefore scene text is embedded in the background as a part of the scene taken. Compared with document images and born-digital images, the scene images, have more complex foreground/ background, low resolution, compression loss, and severe edge softness. This makes the extraction of text from scene text more difficult. Therefore automatic extraction of texts from images or video is a challenging task and research under this field is still under progress.

Text present in images or videos has certain properties and characteristics as described below

(a)Size: The text can be of variable size.

(b)Alignment: The caption texts appear in clusters and usually in horizontal direction. But this does not apply to scene text that has various perspective distortions. The Scene text may be aligned in any direction.

(c)Edge: An edge in the images is the most reliable feature of text regardless of its color, intensity, orientations, etc.

(d)Color: In a simple image the characters in a text usually have the similar or same color. This property mainly makes use of connected component-based approach for text detection. But the video images and other complex color documents usually contain text strings with two or more colors.

(e)Motion: The same text or characters usually appears in consecutive frames present in a video with or without movement. This property is used in text enhancement and tracking. Caption text move in a uniform way: horizontally or vertically. While, scene text possess an arbitrary motion due to camera or object movement.

(f)Compression: The digital images are usually processed in a compressed format. If one can extract text without decompression then it is possible to develop a faster Text Information Extraction system.

II RELATED WORKS

In this section, the recent techniques focused on text detection and localization are reviewed and then the results are discussed.

2.1 Region -Based Technique

Region-based techniques use the properties of the text region such as color or gray-scale or their differences with the corresponding properties of the background. This method mainly uses a bottom-up approach .It groups the small components into larger components until all regions corresponds to text are identified in the image. A geometrical analysis is done to merge the text components using the spatial arrangement of the components so that non-text components are filtered out. The boundaries of the text regions are then marked.

This algorithm is divided into three phases:

i. *Text candidate spotting*: it attempt to separate text from background of the image.

ii. *Text characteristics verification*: text candidate regions are grouped together to discard those regions wrongly selected.

iii. *Consistency analysis for output*: regions representing text are modified to obtain a more useful character representation as input for an OCR

2.1.1 Connected component based methods

CC-based methods are widely used due to their relatively simple implementation. Most of the CC-based methods consist of mainly four processing stages: (a) preprocessing, which includes color clustering and noise reduction, (b) CC generation, (c) filtering out non-text components, and (d) component grouping. A CC-based method could segment a character into multiple CCs, especially in the cases of polychrome text strings and low-resolution and noisy video images. Further, the performance of a Connected Component -based method gets severely affected by component grouping, such as a projection profile analysis or text line selection. In addition, several threshold values must be calculated to filter out the non-text components, and these threshold values are dependent on the image/video database.

J.Gillavata *et al.* [3] proposed a connected component based approach for the text extraction .It is based on color reduction technique and OCR is used for character recognition .It will only detect text with horizontal alignment. Low quality images will not be processed accurately. Zhong *et al.* [4] used a CC-based method, which uses color reduction. In that they quantize the color space using the peaks in a color histogram in the RGB color space. This is based on the assumption that the text regions cluster together in this color space and occupy a significant portion of an image. Each text component goes through a filtering stage using a number of heuristics, such as area, diameter, and spatial alignment. The performance of this system was evaluated using CD images and book cover images. Kim *et al.* [16] use transition map to detect overlay text.

Lienhart *et al.* [5] regard the text regions as CCs with the similar or same color and size, and motion analysis is applied to enhance the text extraction results for a video sequence. The input image given is segmented here based on the monochromatic nature of the text components by using split-and-merge algorithm. They primarily focused on caption text, such as credit titles, pre-title sequences, and closing sequences, which exhibit a higher contrast with the background. This made it easy to use the contrast difference between the boundaries of the detected components and its background in the filtering stage. Finally, they used a geometric analysis, including the width, height, and aspect ratio to filter out remaining non-text components. Based on experiments using 2247 frames, their algorithm extracted 86% to 100% of all the caption text.

2.1.2 Edge Based Technique

Edges are a reliable feature of text rather than the color/intensity, layout, orientations, etc. The three characteristics of text embedded in images which can be used to distinguish the main features of the detecting text are edge strength, density and orientation. Edge-based algorithms are general-purpose method, which can quickly and effectively localize and extract the text from both document and indoor or outdoor images.

Xiaoqing Liu *et al.* [6] method consists of mainly three stages: candidate text region detection, text region localization and character extraction. In its first stage, they used the magnitude of the second derivative of intensity as a

measurement of edge strength, and this allowed a better detection of intensity peaks that normally characterizes text in the images. Edge detector is carried out by using a multiscale strategy, in which the multiscale images are mainly produced by Gaussian pyramids after successively applying low-pass filter and down-sample the original image reducing the image in both vertical and horizontal directions. In the second stage, characteristics of clustering can be used to localize text regions. In the third stage, the existing OCR engine where used. This method is not sensitive to image color/intensity. It can handle both printed and document images effectively. It mainly analyses texts in the form of blocks. But the small image regions and stroke are mis-identified as text in areas containing large characters. Xin Zhang *et al*[7] used the features such as color and edge to extract the text from the video frame. Here, two methods are combined, and is called as color-edge combined algorithm, to remove text background. One of the method that is combined is based on the exponential changes of text color, called Transition Map model, the other one uses the text edges of different gray level image. This algorithm is robust to the image with multilingual text. To improve the efficiency of this method, the edge feature is added to remove background and then edge detection is performed on each color image using Canny operator and some Morphology operation. Finally the background of text is removed with the help of Transition Map model.



Fig. 1. Xiaoqing Liu's Algorithm

The main difference between the method by Sato et al. [8] and the other edge-based methods is the use of recognition-based character segmentation. In those they use character recognition results to make decisions on the segmentation of individual characters, and thus improves the accuracy of character segmentation. The processing time from detection to recognition was less than 0.8 seconds for a 352×242 image.

Anthimopoulos et al. [16] proposed a two-stage methodology for text detection mainly in video images. In its first stage, the text lines are detected based on the Canny edge map of the image. In the next stage, the result is refined using the sliding window and a SVM classifier is trained on features obtained by a new Local Binary Pattern-based operator (eLBP) which describes the local edge distribution. The whole algorithm is used in multiresolution fashion enabling detection of characters for a broad size range.

2.2 Texture-based methods

Texture-based methods use the fact that texts in images have distinct textural properties which distinguish them from the background. The techniques mainly based on Gabor filters, Wavelet, FFT, spatial variance, etc. that can be used to detect the textural properties of a text region in an image.

A texture based method has been applied to vehicle license plate localization by Park *et al.* [9]. They used a time delay neural network as the texture discriminator in the HSI color space. Two time delay neural networks are used as horizontal and vertical filters and each receives the HSI color values for a small window of an input image and it decides whether or not the window contains a license plate number. After combining the two filtered images, the bounding boxes for license plates are located based on projection profile analysis. Mao *et al.* [10] proposed a texture-based text localization method using Wavelet transform. In this work, Harr Wavelet decomposition is used to define the local energy variations in the image at several scales. Binary image, that is acquired after thresholding the local energy variation, is then analyzed by connected component-based filtering using geometric attributes such as size and aspect ratio. All the text regions, which are detected at several scales were merged to give the final result.

2.3 Text Extraction in Compressed Domain

Most of the digital images and videos are usually stored, processed, and transmitted in a compressed form, based on this idea that the text extraction methods that directly operate on images in MPEG or JPEG compressed formats have recently been presented. These methods only just require a small amount of decoding, and thereby it results in a faster algorithm. Moreover, the DCT coefficients and motion vectors in an MPEG video are also useful in text detection [11]. Bergen and Heeger [17] developed a parametric texture synthesis algorithm which can synthesize a matching texture, given a target texture.

Zhong *et al.* [12] worked on a method for localizing caption texts in JPEG images and I-frames of MPEG compressed videos. In this they used DCT coefficients to capture the textural properties, which includes the directionality and periodicity of local image blocks. The results obtained are then refined using morphological operations and connected component analysis. The authors says that, it is very fast (0.006 seconds to process a 240×350 image) and has a recall rate of 99.17% and false alarm rate of 1.87%. However as each unit block is determined as text or non-text, precise localization results could not be generated.

2.4 Morphological Based Text Extraction

Morphology is a geometrical based approach for image analysis. It is used to extract important text features from the processed images. The feature still can be maintained, despite the change in the lighting condition or text color. Algorithm by Rama Mohan *et al.* [13] The method considers that edge detection is more effective in text extraction. Basic operators of mathematical morphology are used to perform the edge detection. The algorithm is used to find out the connected component. By considering the gray levels of the components their variance is found out for each connected component, when components are found then labeling is done. After selecting the components whose variation is less than threshold value the text can be extracted. This method consists of four steps:

- a) Edge extraction
- b) Text candidate region formation
- c) Labeling of text candidate regions
- d) Elimination of non text region

Algorithm by Jui-Chen Wu et al.: Jui-Chen Wu [14] presented a text line extraction algorithm for extracting text regions from jumbled images. The method defines a set of morphological operations for extracting important contrast regions. The main steps of this algorithm are : a) Feature extraction: The relative contrast between texts and their background is an important feature for text line detection. A novel morphology-based scheme for extracting the high contrast feature for locating all possible text lines is used for feature extraction. b) Text candidate selection: a labeling technique is used to select all possible text lines from the analyzed image. c) Candidate verification: After candidate selection a verification process is carried out. The text verifications done on the basis of regularities of character size, the ratio between character width and height, and the period of characters.

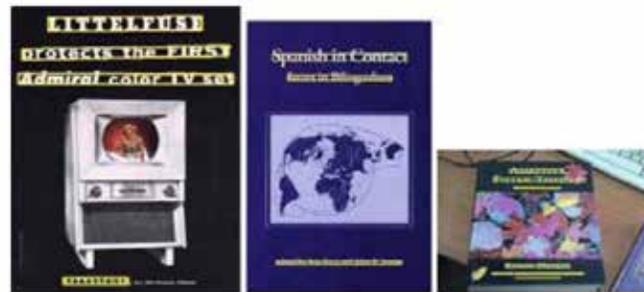


Fig.2 Jui-Chen Wu's Algorithm

2.5 Performance Evaluation

There are several difficulties related to performance evaluation in almost all research areas based on computer vision and pattern recognition (CVPR). The empirical evaluation of CVPR algorithms is a means of measuring the ability of algorithms to meet a given set of requirements. Although various studies in CVPR have investigated about the issue of objective performance evaluation, there has been very little focus on the problem of Text information extraction in images and video. This section discuss the current evaluation methods used for Text information extraction and highlights several issues in these evaluation methods. There are different performance evaluations to estimate the algorithm for text extraction. Most of the approaches quoted here used Precision, Recall and F-Score metrics to evaluate the performance of the algorithm. Precision, Recall and F-Score rates are usually computed based on the number of correctly detected characters (CDC) in an image, it is used in order to evaluate the efficiency and robustness of the algorithm. The performance metrics are as follows:

2.5.1 False Positives

False Positives (FP) or False alarms are those regions in the image that are actually not characters of a text, but have detected by the algorithm as text.

2.5.2 False Negatives

False Negatives (FN) or Misses are those regions in the image which are actually text characters, but have not been detected by the algorithm.

2.5.3 Precision rate

Precision rate (P) can be defined as the ratio of correctly detected characters to the sum of correctly detected characters plus false positives.

2.5.4 Recall rate

Recall rate (R) can be defined as the ratio of the correctly detected characters to sum of correctly detected characters plus false negatives.

2.5.5 F-score

F-Score is defined as the harmonic mean of recall and precision rates.

We have provided a comprehensive survey of text information extraction in images and video. Even though a large number of algorithms have been proposed in the literature, no single method can provide satisfactory performance in all the applications due to the large variations in character font, size, texture, color, etc. There are several information sources for text information extraction in images (e.g., color, texture, motion, shape, geometry, etc). It is very advantageous to merge the various information sources to enhance the performance of a text information extraction system. But there is an issue that it is, not clear as to how to integrate the outputs of several approaches. There is a clear need for a public domain and representative test database for objective benchmarking. The lack of a public test set makes it difficult to compare the performances of competing algorithms, and creates difficulties when merging several approaches.

For caption text, significant progress has been made and several applications, such as an automatic video indexing system, have already been presented. However, their text extraction results are inappropriate for general OCR software: text enhancement is needed for low quality video images and more adaptability is required for general cases (e.g., inverse characters, 2D or 3D deformed characters, polychrome characters, and so on). Very little work has been done on scene text. Scene text can have different characteristics from caption text. For example, part of a scene text can be occluded or it can have complex movement, varies in size, font, color, orientation, style, alignment, lighting, and transformation.

Although many researchers have already investigated text localization, text detection and tracking of video images is required for utilization in many real applications (e.g., mobile handheld devices with a camera and real-time indexing systems). A text-image-structure-analysis, which is analogous to a document structure analysis, is needed to enable a text information extraction system to be used for any type of image, including both scanned document images and real scene images through a video camera. Despite the many difficulties in using TIE systems in real world applications, the importance and usefulness of this field continues to attract much attention for researchers.

III CONCLUSION

In this paper various text extraction techniques are discussed and analyzed. Every approach has its own benefits and restrictions. Though we have large number of algorithms and methods for text extraction from image but none of them provide an adequate output because of deviation in text. Some of the applications of the text extraction system includes Content-based video coding or document coding ,License/container plate recognition ,Text-based image indexing ,Video content analysis document analysis, Industrial automation ,Wearable or portable computers mobile robot navigation to detect text based landmarks,object identification etc. A text-image-analysis, is actually needed to enable a text information extraction system that is to be used for any type of image, including both scanned

document images and real scene images through a video camera. Despite of the many difficulties caused in using TIE systems in real world applications, the importance and usefulness of this field continues to attract much attention

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GREEN HIGHWAYS RATING SYSTEM

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ABSTRACT

A green highway rating system is a proposed standard for quantifying sustainable practices associated with the design and construction of roadways. It can be used to certify roadway projects based on the achievement of a list of project requirements and the total points earned. Such a standard helps improvement and innovation in roadway sustainability, and provide baseline sustainability standards for planning and designing of highways. An attempt is made to frame a green highway rating system based on standards and rating system similar to LEED, GRIHA, etc.

Key words: *Green Highway, Improvement & Innovation*

I. INTRODUCTION

Green highway technology was initiated in USA in the year 2002 and after it is being persuaded in that country through public private participation, a social group, and known as Green Highway Partnership (GHP). The nationwide group of GHP in USA has also identified the characteristics of Green Highway and rating system of Green Roads [3]. The Authority intends to start the systematic educative social movement including applications of Green Highway technology wherever possible in India on the similar pattern of GHP in USA. Sustainable design can be one of the factors that can minimize the impacts of the highway to the environment [2]. Noise, ground and water pollution, habitat disturbance, land use, air, climate change vibration and contamination to plant and wildlife are the effects of construction and vehicle emissions [14]. The impact can be changed by design, construction and management of road, parking and other facilities. In the modern highway design, the new technology such as advance planning, intelligent construction and transport system and maintenance technique has been used to reduce the impact of highway to the environment [9]. Nowadays, green highway rating system becomes a popular tool to confirm the green credential of highways. With the successful implementation of green building rating system, the rating system can be widened into the highway. This rating system was established with the help of existing green building rating system. There are some common criteria that can be found in every green rating system such as sustainable site, water efficiency, energy efficiency, materials and resources and innovation. Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green highways are designed to reduce the overall impact of the built environment on human health and the natural environment. In India the national highways have a total length of 70,934km and serve as the arterial road network of the country. In the world the second largest highway is in India. Growing public awareness of climate change requires transportation professionals to integrate green concepts into transportation planning, design, construction and operation process [4].

1.1 Green Highway Features

A green highway is a roadway constructed as per a relatively new concept for roadway design that integrates transportation functionality and ecological sustainability. An environmental approach is used throughout the planning, design, and the construction. The result is a highway that will benefit transportation, the ecosystem, urban growth, public health and surrounding communities. A green road may not look like normal road at first glance, but with closer inspection a driver will notice subtle difference which will result in improved traffic safety and reduced life-cycle cost [13]. More plant life grows along the shoulder, and more trees are planted as wildlife buffers and ridding quality [1]. In towns, highways become more aesthetically pleasing, and in rural areas highways become a more natural part of the environment.

1.2 Guidelines

To develop a green highway, a project should follow guidelines provided below

- Provide a net increase in environmental function and values of a watershed in GH [4].
- Go beyond maximum standards set by environmental laws and regulations.
- Identify and protecting historic and cultural landmarks.
- Map all resources in the area in order to avoid, identify, and protect critical resource areas [7].
- Use innovative, natural methods to reduce imperviousness, and cleanse all runoff within the project area.
- Maximize use of existing transportation infrastructure, providing multi-modal transportation opportunities, and promoting ride-sharing/public transportation.
- Use recycled materials to eliminate waste and reduce the energy required to build the highway.
- Link regional transportation plans with local land use partnerships [6].
- Control populations of invasive species, and promoting the growth of native species.
- Incorporate post project monitoring to ensure environmental results.
- Protect the hydrology of wetlands and streams channels through restoration of natural drainage paths [8].
- Reduce disruptions to ecological processes by promoting wildlife corridors and passages in areas identified through wildlife conservation plans [14].

1.3 Technology

Green highway construction can incorporate several technical elements including,

- Bio-retention Swales
- Porous Pavements
- Environmentally Friendly concrete
- Forest Buffer
- Restored and Storm water Wetlands
- Stream Restoration
- Wildlife crossing
- Soil amendments

- Storm water Management with Pervious Concrete Pavement
- Irrigation Management & Landscape

Green Highway concept may go on developing in days to come depending upon Socio-economic priorities and research data that may come forth for adding or deleting in the present concept. Highway Research Center has undertaken the above work of implementing the concept of Green Highway in India and making available information on the subject to the concerned peoples & institutes including training to highway engineers [11].

II. NEED FOR A RATING SYSTEM

Green highways are a straightforward means of translating sustainability ideas into definable design and construction practices that are likely to result in a more sustainable roadway [12]. The need for such a system arises for four basic reasons. First, roadways can be more sustainable than they currently are. Current standards and decisions tools do not fully address sustainability. For instance, while pavements are heavy users of recycled materials their design and construction do not consider life cycle emissions or energy use, and ecological considerations can be limited to regulatory compliance. Second, most roadway sustainability efforts to date have not applied a consistent standard by which the relative importance of efforts are judged. Therefore, comparisons between projects are assessment of improvement over time and difficult. Third, the science and engineering underlying roadway sustainability can be complex. Decisions by non-experts that often drive project direction or funding can therefore be problematic. Finally, different aspects of roadway sustainability are difficult to compare because they are not normalized to a common value set. Consequently, it is difficult to get a holistic sense of a roadway's relative sustainability or weigh design and construction trade-offs. It should also be consistent with existing laws, regulations and programs such as the clean water Act, the clean air Act, the national environmental policy Act, the federal highway administration's (FHWA) environmental review toolkit. Finally, it should push the industry to improve on current practices and do more than the required minimum.

III. SCOPE

The expected contribution of green highways include reduce use of virgin materials, reduced energy use, mitigation of environmental burden, promotion of human health and safety, optimization of habitat and land use, improve business and communication and most important is reaffirm our commitment to future generation also. The traditional highway can be converted into green highway right from design process and shall undergo desired changes during construction and maintenance.

3.1 Reasons to Use Economical Alternative Materials in an Eco-Friendly Way

- Increased global warming and climate changes.
- The problem of creation and disposal of non-decomposing materials.
- Increased demand for infrastructures like road with increase in population.
- Limited natural resources for road construction.
- Depletion of good quality material for road construction.
- Increased cost and a question of cost effectiveness.
- Adverse environmental impacts.

To frame a rating system the following 6 factors are mainly considered. It has sub-criteria's to frame a full rating system clearly mentioned [12]. Each criteria aid points are according to their importance in the environmental point of view. The main criteria's are as follows,

- Site selection & planning- (20 points)
- Water conservation- (22 points)
- Energy conservation- (22 points)
- Material conservation- (20 points)
- Environment quality and user's health- (17 points)
- Innovations in design- (14 points)

Totally it gets 115 points, the sub-criteria are clearly mentioned below.

TABLE I. Site selection

S.NO	Site Selection & Planning	Explanation	Available Points
1	Contaminated site remediation [Develop density & community connectivity]	Rehabilitate contaminated sites, where development is complicated by environmental contamination	1
2	Access to public places/shuttle services	Channel development to urban areas with existing infrastructures, most of public places, protect green fields and preserve habitat and natural resources	3
3	Basic amenities	Enhance the overall quality of life by providing amenities within and closer to the site	2
4	Natural topography & landscape 20%, 30%	Minimize disturbances to the highway site. So as to reduce long term environmental effect	2
5	Heat island effect on top layer and parking areas	Reduce the heat within the site areas produced by human activities	4
6	Non fossil fueling facility for vehicles	Encourage the use of non-fossil fuel vehicles to reduce pollution from automobile use.	1
7	Design for differently abled	Ensure that the roadway is user-friendly for differently abled people	2
8	Night sky pollution reduction	Reduce light pollution and façade lighting to increase night sky access and enhance natural environment	1
9	Construction activity pollution prevention	Reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation	1
10	Brownfield redevelopment	Rehabilitate damaged sites where development is complicated by environmental contamination and to reduce pressure on undeveloped land	1
11	Quality control (e g. Storm water)	Limit disruption and pollution of natural water flows by managing storm water runoff	1
12	Tenant design and construction guidelines	Educate tenant about implementing sustainable design and construction features in their tenant improvement build-out	1
	TOTAL POINTS		20

TABLE II. Water Conservation

S. No	Water Conservation	Explanation	Available Points
1	Limit turf area 20%, 30%, 40%	Limit such landscapes which consume large quantity of water	3
2	Drought tolerant species 30%, 40%	Increase the groundwater table or reduce the usage of water through effective and appropriate rainwater management	2
3	Management of irrigation system	Reduce the demand for irrigation water through water-efficient management techniques. Minimize non-process water usage by installing efficient water fixtures	2
4	Rainwater harvesting 75%, 95%	Increase the ground water table or to reduce the usage of water through effective and appropriate rain water management	6
5	Non-process waste water treatment 75%, 95%	Treat non-process waste water either in-situ or in a common effluent treatment plant	4
6	Water use reduction 20%, 30%	Reduce the demand for portable water through water efficient management technique	4
7	Water efficient landscaping 20%, 30%	To limit or climate the use of portable water or other natural surface or subsurface water resources available on /or the project site for landscape irrigation	1
	TOTAL POINTS		22

TABLE III. Energy Conservation

S.No	Energy Conservation	Explanation	Available Points
1	Metering	Encourage continuous monitoring and enhance the performance of highway	2
2	On-site renewable energy 5%, 75%, 100%	Promote self-sufficiency energy through renewable technologies for on-site power generation and use within the site.	6
3	Green power 50%, 75%, 100%	Encourage investments in of-site renewable energy technologies to be support to the grid	6
4	Eco-friendly captive power generation for requirement	Reduce emission levels and their impacts on environment through the use of low emitting fuels or better equipment	2
5	Enhanced commissioning	To begin the commissioning the process and execute additional activities after systems performance verification is completed	1
6	Cool pavement	The temperature is reduced by cool pavement technique	1
7	Quite pavement	Buzzers reduced quiet pavement technique	2
8	Environment	Environmental management system was prepared for the	2

	management system	highway to its individual site conditions	
	TOTAL POINTS		22

TABLE IV. Material Conservation

S.No	Material Conservation	Explanation	Available Point
1	Waste reduction during construction 50%, 75%	Minimize construction waste being send to landfills	2
2	Materials with recycled content 10%, 20%	Encourage the use of products which contains recycled materials to reduce environmental impacts associated with the virgin materials	2
3	Local materials 50%, 75%	Increase the use of locally available materials thereby minimizing the associated environmental impact	4
4	Material reuse 5%, 10%	Encourage the use of salvaged building materials and products to reduce the demand for virgin materials thereby minimizing the impacts associated with extraction and processing of virgin materials	4
5	Certified rapidly renewable material 50%, 75%	To minimize the use of virgin materials thereby encouraging responsible forest management certification	4
6	Storage & collection of recyclables	To facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills	1
7	Pavement life cycle assessment	The pavement is oftenly assessed it should rectify immediately	3
	TOTAL POINTS		20

TABLE V. Environment Quality

S. No	Environment Quality And User's Health	Explanation	Available Points
1	Low VOC materials	To encourage the use of materials with low emissions so as to reduce adverse health impact for users	2
2	Reduction of users fatigue (post occupancy)	Provide facilities for the user to minimize usage related fatigue	2
3	Eco-friendly housekeeping material[chemicals]	Encourage the use eco-friendly housekeeping chemicals which are less toxic so as to reduce adverse health impacts for highway users	1

4	Aerobic & walking area	To enhance the people health of the highway users	2
5	Cycle path	Enhance the people health and reduce the motor vehicle pollution of the highway	4
6	Outdoor air delivery monitoring	Provide capacity for ventilation system monitoring to help promote users comfort	1
7	Portable toilets & government shopping centers	Portable toilets and government rented shops should provide certain distance	3
8	Accessible views and indicators [sensors]	Provide accessible views and indication should provide wherever is necessary	1
9	Signal boards	Provide signal boards and sensors wherever it necessary	1
	TOTAL POINTS		17

TABLE VI. Innovations In Design

S.No	Innovations In Design	Explanation	Available Points
1	Alignment selection	Alignment selection should cover unwanted areas as well as public densified areas	1
2	Context sensitive design	Using the environmental analysis software	1
3	Traffic flow improvement	Traffic flow and safety improvement plan should be innovative	1
4	Safety improvement		2
5	Long life pavement design	Pavement are constructed using new technologies	3
6	LEED Accreditation professionals	Highway should be rated often using rating system.	5
7	Noise mitigation plan	Provides noise reduction accessories in highway.	1
	TOTAL POINTS		14

Certification is based on achieving all requirements and a minimum number of voluntary credit points. *Certified: 35- 45. *Silver: 46-60. *Gold: 61-75. *Evergreen: > 75.

IV. CONCLUSION

Implementation of the green highway rating system will help to improve the standards of the highway and consume less maintenance. It will lead to sustainable highways. All the criteria mentioned above focuses mainly on waste management and quality towards achievement of sustainable highways. The need is to develop and accept the designs and technology which is environment friendly. It improves the highway standards in futuristic view.

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A SUPERVISED LEARNING METHOD TO CLUSTER XML DOCUMENTS WITH REDUCED COMPLEXITY

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ABSTRACT

This paper presents an efficient methodology for clustering of XML documents. Because of enormous amount of XML documents available, it is necessary to find out the method for clustering [Antoine Doucet, 2002] of XML documents. This method groups the XML documents on the basis of the structure and content of XML documents. For Homogeneous XML documents [Nierman, 2002] and Heterogeneous XML documents [Graupmann, 2005], this method to be proved as efficient.

Since there are lots of DTD (Document Type Definition) available for XML documents. So those documents which are of same DTD are called as Homogeneous XML documents and which are of different DTD are called as Heterogeneous XML documents. This method considers both structure and content of documents and find out the cluster to which the document belongs to. Structure similarity is calculated by mining of XML [Denoyer, 2007] tags in the document and content similarity is calculated by using mining of data included in the document.

Keywords: *Clustering, Content, Heterogeneous XML documents, Homogeneous XML documents, Similarity, Structure.*

I. INTRODUCTION

Since the web is the effective source of exchanging of information. These information is exponentially increasing day by day. The form in which it exists that is extensible Markup Language (XML) documents. Because XML documents describe itself and also it is very flexible as it can consist of user defined tags. Web includes Yahoo, Google, EBay, Wikipedia, social networking, government departments and many more. So the web contains a large amount of Heterogeneous XML documents .

Several tools and algorithms developed for storing, mining, retrieving and delivering XML data. However, they also require the efficient method to manage the XML data in such a way that storing of XML documents, retrieving content from XML documents, and delivering XML data.

XML documents are in the form of tree, i.e. they have both starting and ending tags, tag with their attributes, elements and contents. The tag defines the structural property of documents and content defines the content of XML documents. Tags, Attributes and Elements represent the internal nodes of the tree and the content represents the leaves of the tree. So to find out the structural similarity of documents, it is required to consider internal nodes only and for content similarity it is required to consider the leaves also. After finding out the similarity between the documents, it is required to cluster these documents according to some algorithms so that the result for the query gives satisfaction to the user.

In the recent years, there are many algorithms developed to cluster these XML documents. But the problem arises in heterogeneous documents clustering. It also increases the complexity as moves from homogeneous documents to heterogeneous documents.

In the recent years, there are many algorithms developed to cluster these XML documents. But the problem arises in heterogeneous documents clustering. It also increases the complexity as moves from homogeneous documents to heterogeneous documents.

For heterogeneous documents, the tree structure is different, but the content may be same or different for example user queries for the documents i.e. either text or images or videos. So the aim is to search all the useful links or documents regarding the query no matter what is the structure. Therefore, it is a big problem where it is required to search for the content and structure both.

In homogeneous XML documents only the contents is our concern, so the clusters mainly depends on the content of XML documents.

Clustering of XML documents are different from text data and also complicated. Several approaches have been developed for clustering of XML documents based on content or structure or both, but there are still some problems in the terms of complexity and efficiency. Since, there are many challenges in finding out the similarity in Heterogeneous XML documents.

This paper proposes a different strategy to cluster Homogeneous and Heterogeneous XML documents depends on both structure and content. First, the XML documents converted into tree form in which tags are nodes of the tree. For structure similarity, the editing in trees is calculated with the least number of operations and for content similarity, the similarity factor calculated using mathematical formula which will be explained later in paper. In this way, the documents are grouped.

This methodology describes the unsupervised learning of system, in which the system first trained with large number of documents to form clusters and then other documents are tested using this system which gives an efficient way of cluster.

This paper contains the following section. The next section discusses about XML documents with example and also differentiates between Homogeneous and Heterogeneous XML documents. Section 3 consists of the literature survey. Section 4 describes the algorithm for clustering of XML documents. Section 5 consists of System Implementation which describes development of system. Section 6 consists of Mathematical evaluation of algorithm developed. Section 7 consists of results and last section describes the conclusion.

II. HOMOGENEOUS AND HETEROGENEOUS XML DOCUMENTS

XML emerged in 1997 by W3C and it proved to be a powerful language for modeling the information of web. Conversion of web data in the form of XML documents reduces the complexity for different types of applications and after that, a large amount of data are being converted into XML documents in many areas of programming and internet.

```
<?xml version='1.0' ?>
<!DOCTYPE root SYSTEM "http://www.cs.washington.edu/research/projects">
<root>
    <listing>
        <seller_info>
            <seller_name>537_sb_3 </seller_name>
            <seller_rating> 0</seller_rating>

            <payment_types>Visa, Mastercard|
        </payment_types>
        <shipping_info>siteonly, Buyer Pays Shipping Costs
        </shipping_info>
        <buyer_protection_info>
        </buyer_protection_info>
        </seller_info>
    </listing>
</root>
```

Fig. 1: fig1.xml

XML schema describes the XML documents consists of constraint in structure and content both. These schemas define document type descriptor (DTD) of XML documents. XML documents are of different DTD's. It consists of different tags and each tag has its end tag also. These tags are considered as elements. XML documents of same DTD are called as Homogeneous XML documents. XML documents of different DTD are called Heterogeneous XML documents.

```
<?xml version='1.0' ?>
<!DOCTYPE root SYSTEM "http://www.cs.washington.edu/research/projects">
<root>
    <listing>
        <seller_info>
            <seller_name> cubsfantony</seller_name>
            <seller_rating> 848</seller_rating>

            <payment_types>Visa/MasterCard
        </payment_types>
        <shipping_info>Buyer pays fixed shipping
        </shipping_info>
        <buyer_protection_info>
        </buyer_protection_info>
        </seller_info>
    </listing>
</root>
```

Fig. 2: fig2.xml

```
<?xml version='1.0' ?>
<!DOCTYPE root SYSTEM "http://www.cs.washington.edu/research/projects">
<root>
<course>
    <reg_num>10577</reg_num>
    <subj>ANTH</subj>
    <crse>211</crse>
    <sect>F01</sect>
    <title>Introduction to Anthropology</title>
    <units>1.0</units>
    <instructor>Brightman</instructor>
    <days>M-W</days>
    <time>
        <start_time>03:10PM</start_time>
        <end_time>04:30</end_time>
    </time>
    <place>
        <building>ELIOT</building>
        <room>414</room>
    </place>
</course>
</root>
```

Fig. 3: fig3.xml

fig1.xml and fig2.xml are considered as Homogeneous XML documents and fig1.xml, fig3.xml and fig2.xml, fig3.xml are considered as Heterogeneous XML documents. fig1.xml and fig2.xml are of same DTD and consist of same tag and elements but content are different whereas fig1.xml and fig3.xml are of different tags, elements and content.

Since, XML documents consist of opening and closing tags. So it can be denoted in the form of tree where the nodes represent the tags of XML documents.

III. LITERATURE SURVEY

[Kaizhong Zhang and Dennis Shasha, 1989] have proposed the algorithms for editing distance between trees and related problems with the quadratic complexity. In this, one tree is compared with other tree and finding the number of operations required to make both trees identical. The operations are insertion, deletion and modification. If one tree has not one node then it is to be inserted in the tree. If one tree has one node additional at some level then it is to be deleted from the tree and if one tree has same number of nodes on a level then it can be modified. So in this way numbers of operations are calculated. Dynamic programming is used to find out the distance between varieties of trees with same complexit

[Yoon, Jong P., Vijay Raghavan, and Venu Chakilam, 2001] have proposed the BitCube – a three dimensional bitmap indexing form XML documents in which matrix construction time is noticeable. According to this method, the documents are in the form of 2-D bitmap. Then finding out the similarity using variance and mean in bitmap of documents and by using the similarity factors, the documents are being partitioned into clusters. Bit operation takes less time but matrix construction time for large documents is very high.

[Sergio Flesca, Giuseppe Manco, 2002] have proposed Fourier transformation techniques which use the time series representation. Different number of occurrences of an element or small shifts in its position has no effect on similarity estimation. The structure of documents (XML) converted to time series representation in which time noted according to the occurrences of tags and their appearances order in the document. The tags are extracted and converted into the sequence of time frames. Then by applying the Discrete Fourier Transformation (DFT), they can have the sequence of frequencies. Encoding schemes are being used to find out the signal samples for the documents. So this method is as effective as tree edit distance.

[Theodore Dalamagas, 2006] have proposed hierarchical algorithm for clustering documents which has quadratic complexity for single link and product of quadratic and logarithmic for complete link. The methodology is used to cluster XML documents by structure for similar documents by structure and also improve the performance of the edit distances.

[Jianwu Yang and Songlin Wang, 2010] have proposed partitioned clustering algorithm for clustering with linear time complexity but the problem arises in sensitivity to initial center points and the assumption of knowing number of clusters. Authors used k-means algorithm to find out clustering of XML documents based on text but improving the quality by using the tags. For finding similarity, vector space model is used and k-means for clustering.

[Bin Zhao, 2008] have proposed combination algorithms for clustering which make them robust than single partitioned algorithms. Authors combined the single link partition algorithm and hierarchical clustering algorithm and eliminate the problems in single link clustering algorithm. XML documents are represented in the form of n-D vector.

[Elaheh Asghari, 2013] have proposed the multilevel clustering algorithm by applying different degrees of importance on different levels of elements in the tree make them efficient methods for clustering XML documents. Author proposed the algorithm to apply different clustering algorithm on different levels so it is very difficult to determine which algorithm to apply on which level. So the time complexity and the quality of cluster depend on level selected and algorithm selected.

IV. ALGORITHM

The algorithm developed has four steps to cluster the XML documents. These four steps are Document Representation, Structure Similarity, Content Similarity, and finally to find out the cluster. In the first step, representation of document is described. The second step describes the method to find out the similarity between the structure and the third step describes the method to find out the similarity between the content of documents. Finally the last step is used to find out the cluster of the documents to which it belongs.

4.1 Document Representation

XML documents are represented in the form of tree (bracket notation) in which tags represent nodes of trees. Structure of document is stored in the file of .tree extension and content is stored in text file. Since the XML documents must have the end tag for each and every start tag so it can be transformed in the form of tree. For example fig1.xml can be written in fig1.tree, fig2.xml represented in fig2.tree and fig3.xml represented in fig3.tree. So in this way the XML document are being represented as in the form of tree. Nodes in fig1.tree and fig2.tree are similar so called as homogeneous XML documents whereas fig3.tree and fig1.tree or fig3.tree and fig2.tree are heterogeneous XML documents.

```
{root
  {listing
    {seller_info
      {seller_name}
      {seller_rating}
      {payment_types}
      {shipping_info}
      {buyer_protection_info}
    }
  }
}
```

Fig. 4: fig1.tree

```
{root
  {listing
    {seller_info
      {seller_name}
      {seller_rating}
      {payment_types}
      {shipping_info}
      {buyer_protection_info}
    }
  }
}
```

Fig. 5: fig2.tree

```
{root
  {course
    {reg_num}
    {subj}
    {crse}
    {sect}
    {title}
    {units}
    {instructor}
    {days}
    {time
      {start_time}
      {end_time}
    }
    {place
      {building}
      {room}
    }
  }
}
```

Fig. 6: fig3.tree

The tree format is extracted by using stack in which for every start tag, one '{' and the tag is pushed in the stack and for every end tag, one '}' pushed into stack. Finally in this way the tree form of XML document extracted.

4.2 Structure Similarity

The structure similarity between two trees t1 and t2 depends on difference of nodes in trees. String comparison operation is required in comparison of two nodes. If it is similar then no need to increase the value of count but if it is different then increase the count by 1. So in this way, finally get the result of number of different nodes in two trees.

Now the number of operation for every tree pair can be calculated but the reciprocal of this value is to be considered as ES[ij](equality in structure of tree i and tree j).

If the number of operations required is zero then the reciprocal considered as 1 i.e, the most similar tree.

4.3 Content Similarity

Content similarity means similarity on the basis of content. Content is the text between the nodes of the tree. So for each and every tree there is a document file which consists of the content of XML document. To find the similarity of content between tree pairs, following steps to follow.

Collection of documents are pre-processed and represented as term document matrix.

Entry in matrix corresponds to the weight of a term in a document.

Zero means term has no significance in document.

f[ij]: frequency of term i in document j.

term frequency(tf[ij])= f[ij]/max(f[ij]) where max(f[ij]) is frequency of most common word in document.

Terms that appears in many different documents.

df[i]= document frequency of term i i.e number of documents containing term i.

idf[i]= inverse document frequency of term i

= lg(N/df[i]) where N is total number of documents.

Log used to dampen the effect relative to term frequency.

w[ij]= tf[ij]*idf[i] where w[ij] is the weight of term i in document j.

EC[i,j] is the equality in content between two documents which is calculated as summation of the product of weight of common words in both trees and normalized using square root of the square of common words.

4.4 Clustering

Clustering means to collect the objects which are similar between them belongs to one group and dissimilar objects belong to other group. Cluster for homogeneous XML document, based on equality in structure whereas for heterogeneous XML documents based on equality in content. There are number of groups selected and for every group there are some documents belong to those groups which can best describe the group and also the corpus developed for every group which consists of the content of all documents which are available in the group. Now for every group, one document selected as the center for that group which can be used to calculate the ES for the document and the corpus used to calculate EC. In this way, determination of cluster for XML documents accomplished.

V. SYSTEM IMPLEMENTATION

The system developed for implementing this algorithm, uses the supervised learning in which training document defined for every group and based on these documents, other documents are tested to find out their groups. There are five groups which are Books Shopping, Music, Astrology, Colleges and Science. Each group consists of large number of documents which are related to their groups. In every group, there is a central document selected which has highest ES with maximum number of documents in the group. The content of all documents in the group stored in a document file and then the file is pre-processed. There is a threshold value to be decided for making the decision of the group for XML document, if ES smaller than that value then the document can not belong to that group and if Es is greater than that value then the document can belong to that group. So now, the system is ready for testing. The group of XML document determined on the basis ES and EC. The ES calculated for an XML document with central document of every group and the document belongs to the group with which it has highest value of ES but the value must be greater than threshold value. But if the ES value with every group is smaller than threshold value then calculate the value of EC with the document file of every group. There is other threshold value decided for content so if the value of EC is smaller than that value, document can not belong to that group but if value is higher than document may belong to that group. Now the document belong to the group with which it has the highest value and greater than the threshold value. If document has both ES value and EC value less than the threshold value decided with each and every group then it does not belong to any of the group and it is placed in additional group.

VI. EVALUATION

The analysis of complexity of clustering of homogeneous and heterogeneous XML documents in the following manner.

Let the center of group consists of n nodes and XML document whose group is to be decided has m nodes. So $n[1]$ is number of nodes for group 1, $n[2]$ for group 2 etc. Let the number of groups is k . Let the number of words in document file of group has w words and document file for new XML document has x words. So $w[1], w[2], \dots, w[k]$ is number of words in document file for group 1, 2, ..., k .

Time required for extracting tags and extracting content to respective file is very less as compared to other factors if the speed of traversing a file is very less as compared to other factors. So it can be ignored.

Now complexity for clustering of homogeneous XML document is $\max(m, n)$ where \max indicates maximum and it is required for every group. $\max(m, n[1]) + \max(m, n[2]) + \dots + \max(m, n[k])$ is the total complexity. Since the number of groups are very less as compared to number of documents and number of nodes. So it is very less than quadratic.

Now complexity for clustering of heterogeneous XML documents is $(\max(m, n[1]) + \max(m, n[2]) + \dots + \max(m, n[k]) + x \cdot \log(w[1]) + x \cdot \log(w[2]) + \dots + x \cdot \log(w[k]))$ where $\log(w[1])$ is the searching time of one word in file of group 1 by using universal hashing data structure. Since the number of groups is very less as compared to number of nodes and numbers of words in document file so the complexity is less than product of quadratic and logarithmic function which is previously defined in literature survey. In this way the complexity for clustering for both homogeneous and heterogeneous XML document reduces by reasonable amount.

Now these comparison of new documents with central documents can be done in parallel way then $\max(m,n[1]) + \max(m,n[2]) + \dots + \max(m,n[k])$ can approach to the $\max(m,N)$ where N is the number of nodes which is maximum among all the central documents and $x \cdot \log(w[1]) + x \cdot \log(w[2]) + \dots + x \cdot \log(w[k])$ can approach to $x \cdot \log(W)$ where W is the number of words in largest document file of group among all document file of groups . Finally the complexity for clustering of homogeneous XML documents reduces to $\max(m,N)$ and for heterogeneous XML document reduces to $\max(m,N) + x \cdot \log(W)$.

VII. RESULTS

In the above section, we have described about the complexity to find out the cluster for an XML document by using supervised way. We have seen that the complexity for clustering of homogeneous XML document and heterogeneous XML document reduced. Table 1 indicates the results shown for homogeneous XML documents. Let the time unit(tu) for one insertion or modification or comparison in a tree is equal to 1 tu . This is indicated in time unit as because this value depends on the processor speed and memory size.

Table1

Category	Central Doc. Nodes	Tested Doc. Nodes	Time(in tu)
Book Shopping	145	150	209
Music	175	163	209
Astrology	134	135	209
Colleges	209	207	209
Science	178	180	209

Table 2 shows the results for Heterogeneous XML documents. CentralNodes represent the number of nodes in central document, TestedNodes represent the number of nodes in tested document, Category (words) and Tested (words) represent the number of words in category or group document and tested document respectively.

Table2

Category	CentralNodes	TestedNodes	Category(words)	Tested(words)	Time(tu)
Book Shopping	145	175	510	475	1622.5
Music	175	135	310	305	1116.6
Astrology	134	125	754	510	1905.3
Colleges	209	150	524	564	1887.4
Science	178	135	94	839	2705.8

The results are tested for about 500 homogeneous XML documents and 400 Heterogeneous XML documents. Trained documents are 100 for every group out of which one is selected as central document and for every group there is one document file maintained.

VIII. CONCLUSION

We have defined the methodology for clustering of homogeneous XML documents and heterogeneous XML documents with reduced complexity by considering both structure and content of XML documents. For structure, we have converted every XML document in the form of tree and the compared two XML document to find structure similarity and for content similarity, we have formed the document file for every document which consists of its content then find out the similarity by using term frequency and document frequency. So this algorithm gives the result according to the reduced complexity.

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OPTO-THERMAL CHARACTERIZATION OF NEODYMIUM-DOPED ZINC-PHOSPHATE GLASSES

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ABSTRACT

Zinc-Phosphate glasses have superior physical properties such as high thermal expansion coefficients, low melting temperatures and high ultra - violet transmission. Zinc-Phosphate glasses also find their application as a potential substrate for femtosecond Laser writing. But poor chemical reactivity and low light absorbance limit their further scope in advanced technological applications. In the present work, a series of Nd doped Zinc-Phosphate glasses have been studied by the Laser Optoacoustic technique, for investigating the parameters like Optical Energy Gap and thermal diffusivity. Like the optical energy gap, the thermal diffusivity is an important physical parameter not only for its intrinsic physical interest, but also for its use in device modeling and design. Thermal diffusivities of glass samples have been determined using phase shift method in the framework of the one-dimensional heat flow model of Rosencwaig and Gersho. Further analyses suggest that grain boundary resistance and interface thermal resistance influence the effective value of thermal diffusivity of the samples under investigation. The phonon assisted heat transfer mechanism also play an important role in the variation of thermal diffusivity. It is also observed that, doped samples have a reduced value for thermal diffusivity in comparison with the intrinsic glass sample. It is also seen that thermal diffusivity is very sensitive to structural variations arising from doping of Nd. We also observed that, while the phase of the Optoacoustic signal varies linearly with the square root of chopping frequency for doped samples, the intrinsic material does not exhibit such behavior in the experimental frequency range.

Keywords: Thermal diffusivity, Optical Energy Gap, Optoacoustics, Characteristic Frequency

I INTRODUCTION

Ceramics are the first choice in variety of applications to solve a number of scientific and technological problems due to the easy availability of raw material as well as their thermal stability and resistance to corrosion. Zinc-Phosphate glasses are important class of the ceramics having enough design flexibility options, resulting in various optoelectronic or insulating applications. Knowledge of the thermo-optical parameters of a glassy material is quite important for examining the potential of the material to be used in above mentioned applications. The analysis of the glassy state is based primarily on the theory of semiconducting and insulating crystals. Even for the crystalline state there are many complications in the way of a definitive prediction of the absorption coefficient, α in the fundamental region, since it requires detailed knowledge of the wave function of whole crystal. More complications

are caused by some basic problems like crystal imperfections, presence of lattice phonons at experimental temperature and surface states etc. The gap in energy present between the valance and conduction bands of any material greatly affects the properties of that material. This gap in case of glasses is an important parameter for their various applications in research and industry. As most of the glasses are transparent and very weak absorbers of light, they pose difficulties when subjected to the conventional transmission or reflection measurements. Although, there are various methods for the determination of band gap energies (e. g. resistivity measurements, variation of saturation current with temperature etc.), Optoacoustic (OA) technique has drawn the increasing attention of the research community, as a tool not only for determination of optical absorption spectra but also for the investigation of various properties like thermal diffusivity, thermal effusivity, optical absorption coefficient and energy band gap¹⁻³. Among all kinds of photothermal detection techniques, the method of optoacoustics is always being the first choice due to its simple and elegant experimental set-up and its capability to provide material parameters with great accuracy⁴. The method of Optoacoustics is based upon the non-radiative de-excitations produced in the sample, after absorbing a monochromatic chopped electromagnetic energy. The heat generated in the sample creates pressure fluctuations in the adjacent coupling gas compartment and can be detected using a microphone or piezoelectric transducer. Thermal Diffusivity has been used as an indicator for the utility of materials as an insulator or heat conductor. It is a measure of the rate at which a body with a nonuniform temperature reaches a state of thermal equilibrium. Further, the efficient use of OA technique for determination of energy band gap and thermal parameters of different samples^{5,6} was the motivation to select the optoacoustic technique as a tool to study the newly formed glass series of present work for various properties. This technique has efficiently been used for studying the weakly light absorbing samples like ice, snow and polymers⁶⁻⁸. Various workers⁹⁻¹² used OA technique for the determination of Optical energy gap and other various properties of semiconductors and glasses.

Whenever a light travels through the bulk of the sample material, it takes some time in crossing through the sample. Or in other words, there is phases lag or phase shift between the output signal and the original (reference) signal. The measurement of this phase lag enables us how the heat transmission profile of that sample actually is. The variation of phase shift of the optoacoustic signal when plotted with the chopper frequency, one can observe such a point where phase shift ceases to change with the increase of the chopping frequency. At this point, sample changes from thermally thin to thermally thick. The frequency at which this change occurs is known as sample characteristic frequency.

The thermal diffusivity S of the sample is given as¹

$$S = f_c l_s^2 \text{-----(1)}$$

Here f_c is the sample characteristic frequency, l_s is the thickness of sample.

Rosencwaig and Gersho were the first to present a quantitative derivation for the optoacoustic signal in terms of optical, thermal and geometrical parameters of the system. According to the Rosencwaig - Gersho (RG) theory¹², the variation of gas pressure $\Delta P(t)$ (or roughly the optoacoustic signal), with regard to the time and to characteristic parameters of the different media; the gas (g), the sample (s) and the sample holder (b), inside the PA cell is given by- The variation of gas pressure (or simply, the optoacoustic signal) is given as¹³

$$DP(t) = \frac{P_0 q m_g}{\sqrt{2L_g T_0}} \exp\left\{j\left(\omega t - \frac{\rho}{4}\right)\right\} \dots \dots \dots (2)$$

Where,

L_g = thickness of the sample,

m_g = the thermal diffusion length,

g = the ratio of specific heats of the gas,

P_0 = static pressure,

T_0 = average temperature and

ω = pulsation frequency of incident light.

q , the variation of temperature at the gas-sample interface is given according to RG theory of OA signal generation.

$$q = \frac{bI_0}{2k_s (b^2 - s_s^2)} \left[(r - 1)(b + 1) \exp(s_s L_s) - (r + 1)(b - 1) \exp(-s_s L_s) + 2(b - r) \exp(-b_s L_s) \right] \\ + \left[(g + 1)(b + 1) \exp(s_s L_s) - (g - 1)(b - 1) \exp(-s_s L_s) \right] \dots \dots \dots (3)$$

or, if we assume $g \ll 1$,

$$q = \frac{bI_0}{2k_s (b^2 - s_s^2)} (r - 1) \dots \dots \dots (4)$$

Expressing r and s_s , q is

$$q = \frac{bI_0}{2k_s} m_g^2 \frac{\exp[-j \arctg\{(bm_g + 2)/bm_g\}]}{[(bm_g)^2 + (bm_g + 2)^2]^{1/2}} \dots \dots \dots (5)$$

The expression for optoacoustic signal is

$$DP(t) = \frac{Abm_g}{m_g [(bm_g + 1)^2 + 1]^{1/2}} \exp\left\{j\left(\omega t - \frac{\rho}{4} - \arctg\left\{\frac{bm_g + 2}{bm_g}\right\}\right)\right\} \dots \dots \dots (6)$$

$$\text{with } A = \frac{P_0 I_0 (a_g a_s)^{1/2}}{2L_g T_0 k_s} \dots \dots \dots (7)$$

When $bm_g \gg 0$, the value of optoacoustic signal goes to

$$DP(t) \approx \frac{A}{w\sqrt{2}} b m_j \exp \left[\frac{3\rho \ddot{u}}{4 \dot{u}} \right] \dots \dots \dots (8)$$

Above expression shows the direct dependence of optoacoustic signal on the optical absorption coefficient in case of thermally thick samples. A rigorous mathematical treatment¹⁴ gives following relationship between optoacoustic signal and optical absorption coefficient.

$$a = \frac{1}{m_j} \left[\frac{q^2 + q(2 - q^2)^{1/2}}{(1 - q^2)} \right] \dots \dots \dots (9)$$

Urbach¹⁵ suggested that at small values, absorption coefficient varied with both frequency and temperature.

$$a = a_0 \exp \left\{ \frac{g \{ h\nu - E_g(0) + bT \}}{kT} \right\} \dots \dots \dots (10)$$

Where *a* is the absorption coefficient, which depends on temperature *T* and the light energy *hν*, *a*₀ and *g* are constants, *E_g(0)* is the energy gap value of the glass and *b* is the energy-gap temperature coefficient, which is determined from equation

$$E_g(T) = E_g(0) - bT \dots \dots \dots (11)$$

In the quantum mechanical sense, for allowed direct transitions in glass, we may write^{16,17}

$$ahn = A(h\nu - E_g(0))^{1/2} \dots \dots \dots (12)$$

So, the plot between (*ahn*)² and *hν* will then give a straight line and we can estimate the band gap energy *E_g(0)* from the intercept on x axis. The Urbach energy corresponds to the width of the tail of localized states within the optical band gap. It is linked to the absorption coefficient in the lower energy region of fundamental edge and can be described by-

$$a = a_0 \exp \left\{ \frac{ah\nu - E_u}{E_u} \right\} \dots \dots \dots (13)$$

Here, *E_u*= Urbach energy

II MATERIALS AND METHODS

For the preparation of glass samples Sodium di hydrogen orthophosphate and Zinc Oxide, in the ratio 3:1 by weight are taken in a beaker and stirred continuously with the help of an electrically driven stirrer, so as to obtain a homogeneous mixture. The mixture is then put in to an electric furnace (capable of achieving temperature up to 12000C) in a platinum crucible at a temperature ranging from 8500C to 9500C for half an hour. The molten mass is then poured in to a brass ring (mould) resting on an aluminum plate. The glass so formed is then allowed to cool at the room temperature.

For recording the optoacoustic spectra of these samples with various doping percentage of Nd₂O₃ were crushed finely and a single particle layer was prepared on an adhesive tape. This single particle layer of the glass samples supported by the adhesive tape is then placed inside the sample cavity of the Optoacoustic cell⁵. Various components of the

experimental setup are shown in Fig 1. Two kinds of Optoacoustic experiment were performed; one by varying incident light chopping frequency from 5 Hz to 300 Hz, at fixed wavelength (using He-Ne laser), and another by varying the wavelength of incident light of the Xenon-arc lamp from 200 nm to 700 nm and keeping the chopping frequency fixed.

III RESULTS AND DISCUSSIONS

The relation between absorption coefficient, α , frequency at band edge, and temperature, in principle allow a distinction between transitions of different nature. We should first distinguish between transition to localized states, which produce intense absorption bands with well-defined maxima (exciton bands) and transition to conduction bands in which the absorption is continuous at energies above the band edge. The former are expected to lie at lower energy than the later because the exciton states take advantage of the binding energy between ejected electron and positive hole, which it leaves behind, whereas transition to the conduction band leaves the electron free. However, the relative energies of excitons and conduction band levels cannot be predicted without the solving the Schrödinger equation for the crystal and in many cases it seems that the continuum of conducting states is sufficiently broad at the equilibrium atomic spacing of the actual lattice that it overlaps the exciton levels. Exciton levels are most clearly observed in the more ionic crystals, in which conduction bands are narrow and at high energy. For the same regions, high intensity bands of exciton type are also prominent in short wavelength spectra of glasses. However, these bands usually fall in the UV region and in some cases shifts towards visible or infrared regions. In accordance with this discussion, for all the glasses when photon energy is plotted with the optical absorption coefficient, a sharp absorption edge occurs. The same phenomenon has also been observed for the glass series of present work.

The variation of phase with chopping frequency has been shown for various Zinc-phosphate glasses in Fig. 1. It is clear from these curves that, for each Zinc-Phosphate glass there exists a characteristic frequency after which the phase shift becomes constant with increasing chopping frequency. Thermal diffusivity of any sample has been calculated by locating the characteristic frequency (f_c) in the Chopping frequency versus phase shift graph using equation 1. The thermal diffusivity values for various glass samples determined in present work are given in table 1. These results are in the similar range that reported in literature for other glass families by various other workers^{19,20, 11}. It is evident from the table 1 that thermal diffusivity decreases with increasing concentration of Nd. In ceramics two mode of heat conduction are possible firstly due to atomic movement or due to phonons and secondly due to the electron transitions (radiative transfer consisting of photons). However, in glassy materials the electron concentration is quite low, therefore the thermal energy is transferred through phonons mainly. Also, the pores available inside the glass matrix act as scattering centers for phonons, affecting the mean free path and thermal diffusivity. Increasing doping concentration reduces the available scattering centers and ultimately reducing the thermal diffusivity value.

The grain boundaries inside the glass structure also affect the propagation of phonons and hence their thermal diffusivity value. Thicker grain boundaries may lead to the reduction in the thermal diffusivity value due to multiple scattering of phonons.

Fig. 3 show the variation of absorption coefficient α with photon energy ($h\nu$) for various zinc phosphate glasses doped with Nd_2O_3 . In all curves, we observe an absorption edge. Glasses generally show the absorption edge in the UV range,

but if any of the glass contains heavy atoms like that in present work, the absorption edge shifts to the visible or even to the infrared region²¹. Pardeset al²² also reported the same kind of shifting of absorption edge from ultraviolet to visible region when the composition of anhydrous boric oxide was increased in the soda-lime glasses. The presence of this absorption edge in the spectra of any glass is mainly depends upon the content of network modifier. The absorption edge of a non-metallic, crystalline or non-crystalline material is determined by the fundamental absorption¹². When electron hole interactions are neglected, the density of states profile is well shaped and is proportional to some power of energy. The values of the thermal diffusivity and energy band gaps of the samples of present work are tabulated in table 2. We observe a downward trend around Nd =0.4 Wt %. Similar type of variation was also observed by Ghosh et al² for Zn-Se-Te glasses by optoacoustic spectroscopy and by Ebina et al²³, who determined the energy band gap of ZnSeTe glasses by reflectivity measurements. We may say that, up to the Nd = 0.4 wt % the value of energy band gap will be determined by the energies and various type of bonds, which in turn determine the width of valance and conduction bands as well as the location of Fermi level. As we increase the Nd concentration, the unsaturated defects inside the glass are gradually annealed out due to thermal annealing producing large number of saturated bonds²⁴. The reduction in the number of unsaturated defects decreases the density of localized states in the band structure, consequently increasing the energy band gap. Although, the energy band gap of glasses of present work is not available in the literature, the energy band gap determined in the present work is in the range that calculated by various other workers for other glass families. Ghosh et al² have reported the band gap of Zn-Se-Te glasses in the range (1.5-1.6 eV). They used optoacoustic spectroscopy technique for the measurement of the optical band gap. Srinivasan et al²⁰ reported the energy band gap of Ge-Sb-Se glasses in the range (2.30-2.75 eV). They also utilized optoacoustic spectroscopy for the determination of energy band gap of various glass samples. Mathew et al²⁵ have reported the energy band gap of As-Sb-Se glasses in the range (1.45-1.75 eV). They have calculated the energy band gaps through photoconductivity measurements.

IV CONCLUSION

Due to very weak absorbance, it is always difficult to record the absorption spectrum of glasses. Also, due to poor absorbance, determination of both thermal and optical parameters is always tedious and prone to errors. Optoacoustic technique, being based upon non-radiative de-excitations, is free from all such issues. Thermal diffusivity values of the various samples were determined by the phase lag frequency domain analysis. The values are compared with the thermal diffusivity values reported in the literature for the other glass families. The reducing trend of thermal diffusivity values with increasing trend is attributed towards the reduced freedom of phonon movement, as pores in the glass matrix are filled up by the dopants. Grain boundaries inside the glass structure are another hurdle in the photon movement. Glasses show an absorption edge when absorption coefficient is plotted against the incident photon energy. Energy band gaps of the samples were calculated by using Urbach relationship, which indicates towards the semiconducting nature of the present glass series. Thus, present technique offers an efficient method for determining the optical absorption coefficient, thermal diffusivity and energy band gap.

Table 1: Observed values of thermal diffusivities and energy band gaps of Zinc-phosphate glasses with different Nd concentration

Nd Concentration (Wt %)	Thermal Diffusivity (a)	Energy Band Gap $E_g(0)$ (eV)
0.0 (Pure)	1.52	1.7
0.2	1.50	1.6
0.3	1.50	1.5
0.5	1.49	1.55
1.0	1.48	1.5

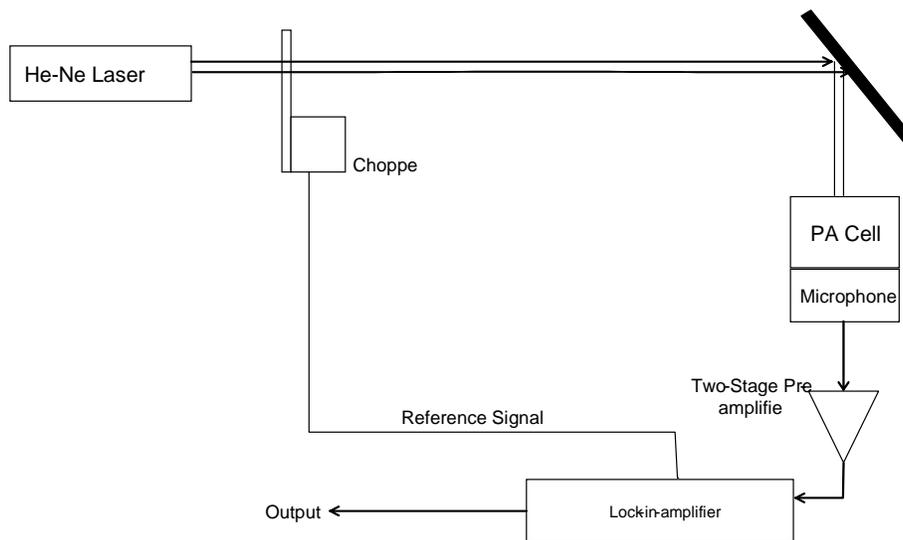


Fig.1 Experimental setup for Optoacoustic Phase measurement

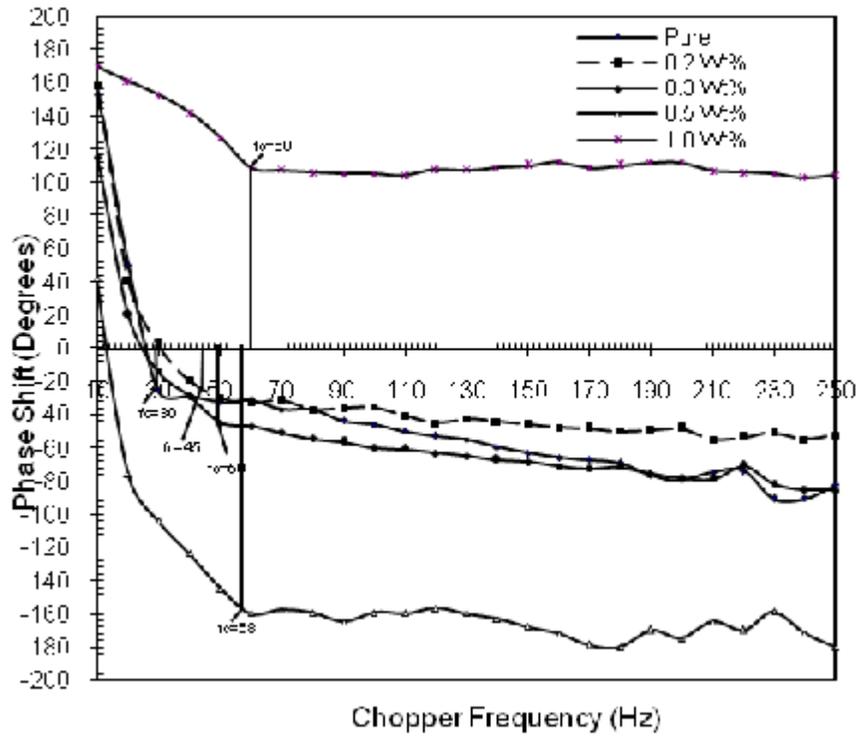


Fig. 2 Optoacoustic phase variation of Zinc-Phosphate glasses with doping of Nd

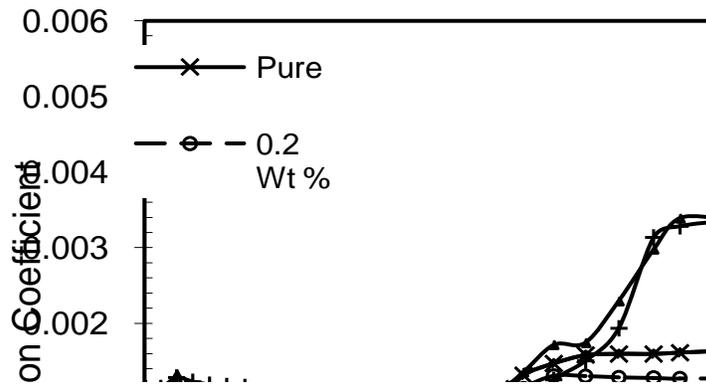
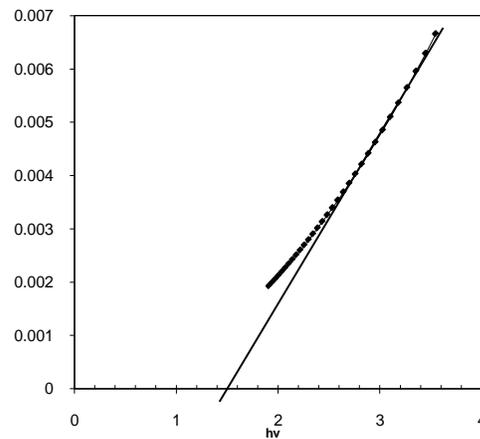
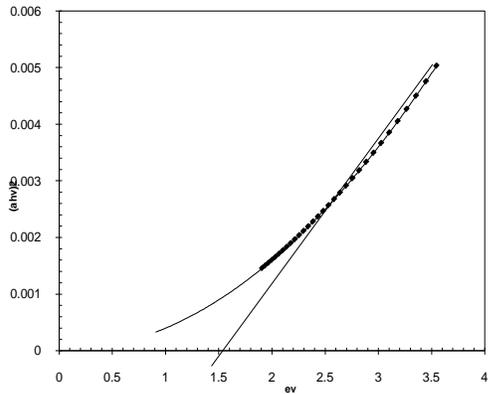
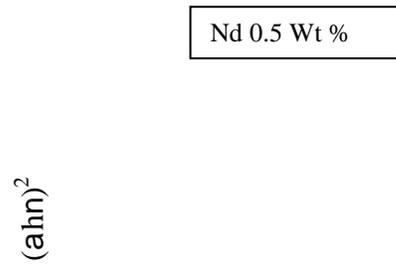
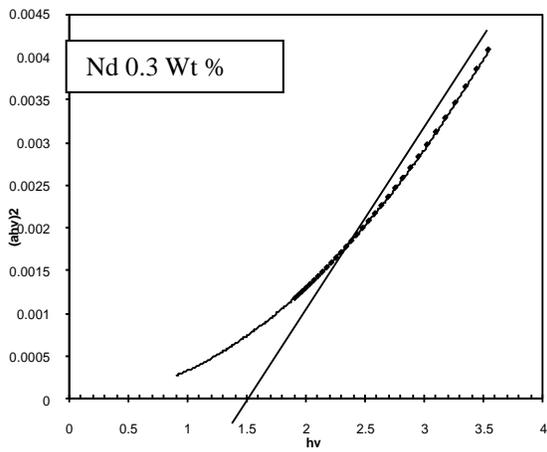
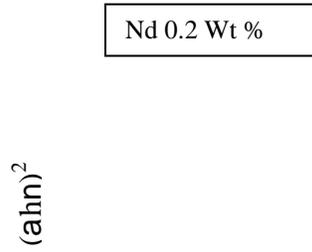
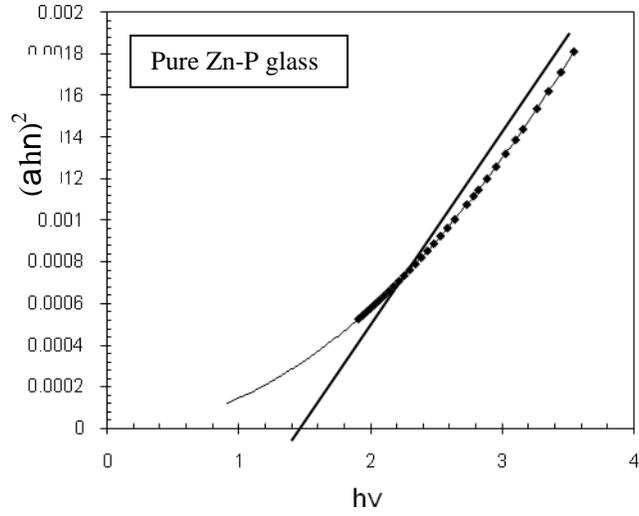


Fig.3. Variation of the absorption coefficient (α) as a function of photon energy ($h\nu$) of Zinc-Phosphate glass with doping of Nd



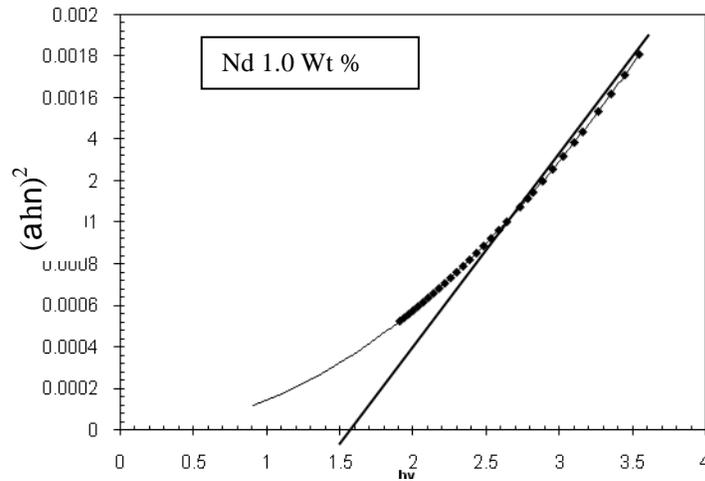


Fig. 4. Variation of the $(\alpha hn)^2$ as a function of photon energy hn for Zinc-Phosphate glasses with various doping concentration of Nd

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