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FROM THE EDITOR'S DESK

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It is a moment of pride and great satisfaction to place in the hands of our esteemed readers' **the first issue** of "JK Journal of Architecture and Engineering Sciences**".**

The Department of Higher Education is tirelessly working for promotion of learning in the State of Jammu & Kashmir. In recent past, the Department has taken many path-breaking initiatives to take higher education system to newer heights. In a historically significant decision, the Department has begun promoting quality research in colleges with initiation of publication of a galaxy of research journals in pure/applied sciences, social sciences, humanities, and languages. The Department is constantly striving to create new avenues to benefit students and society at large. We need to bring in advanced teaching techniques in our Colleges and Universities for achieving better results in higher education sector in tune with recent ICT trends to make J&K a hub of academic excellence for quality education. In today's rapidly changing education scenario the teaching fraternity should constantly evolve methodologies and innovative techniques to achieve better results.

Our consistent endeavor is to take Higher Education sector to newer heights by improving equity, access, quality, promoting academics, research, curriculum reforms, teacher training, infrastructure and co/extra-curricular activities in our State to be amongst top ranking states of India in coming years. We need to create a conducive environment for "quality research" and "teaching" in our colleges under the State Knowledge Initiatives platform (SKIP), we are finalizing a "vision document" and policy road map for education which includes knowledge townships and knowledge clusters. We are setting up more skill institutes in areas like architecture, paramedical/ medical sciences and engineering sciences. We are also promoting ICT initiatives like Edusat, e-governance, office administration, bio-metric attendance and smart classrooms, besides improvement of work culture that for raising standards of learning and skills.

 The Department is boosting technical education with establishment of new Engineering Institutes at Kathua and Safapora under RUSA and new Schools of Architecture at Srinagar and Jammu. We have made huge strides recently in technical education sector with establishment of IIT, Jammu and IIM, Jammu at a project cost of Rs. 1000 Crore each; besides, MoHRD (world bank) funded Rs. 100 crore TEQIP (phase III) project for improvement of overall standard and quality of Technical

Education in Four technical institutions viz. GCET, Jammu; IUST Kashmir; SMVDU, Katra and BGSBU, Rajouri in the State.

IIT Jammu was established in 2016 and so far two batches have joined and 3rd batch is expected in July, 2018; Director and core faculty appointed and shifted in 2017 to permanent campus at Jagti Jammu while PG courses in "tunnel engineering" are being started very soon: Director, IIT, Jammu is mentoring state engineering colleges at Jammu. Director, NIT, Srinagar is mentoring GCET at Safapora, Kashmir; NIT Srinagar as being upgraded with a grant of Rs. 100 crore under PMDP; IIT, Jammu and IIM, Jammu out-campuses are also proposed at Srinagar very soon. IIM, Jammu was started in 2016 in transit campus at Jammu city and two batches of students have joined and first convocation was held recently with proper placement of the students.

The state Higher Education Department also planning to start an Indian Institute of Information Technology with assistance of GOI & in partnership with industry and a School of Planning & Architecture very soon.

JK Journal of Architecture and Engineering Sciences is one such initiative of the State Higher Education Department; it is a **quarterly** Research Journal with international dimensions to provide an intellectual platform to our teachers and scholars to explore the universe of technological advancements through intensive research, discussions and debate. The Journal is not limited to specific aspects of engineering and architecture but instead devoted to a wide range of related fields in engineering and architecture. The papers of interdisciplinary nature are particularly welcome. This Journal strives to maintain high quality of publication and will definitely provide much needed impetus to technical research work in the state and ultimately help in projecting and tweaking our abilities at par with the international scenario.

I wish this Journal infinite growth and eternal success.

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CONTENTS

Materials Engineered for the Photocatalytic Degradation of Dyes in Waste Water

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Abstract: Organic dyes used in textile and food industries are the important sources of environmental contaminations due to their non-bio degradability and high toxicity to aquatic creatures and carcinogenic effects on humans. This demands environmental remediation by the use of techniques which are environmentally benign. For this purpose, a general overview of dye degradation by light in the presence of materials engineered as photo-catalysts has been given. The mechanism of action has also been described. Importantly, the materials involved in dye degradation usually involve nano-composites of either conducting polymers or metal-oxidesor graphene based systems which are insoluble in aqueous solutions, hence will be environmentally benign and can therefore be recovered after use.

Key words: *Nano-materials; Organic dyes; Photocatalysis*

Introduction And Criteria For Materials To Be Best Photo-Catalysts For Dye Degradation

The use of dyes in textile industries has become a serious environmental issue because of the unacceptable color of dye effluents, high chemical oxygen demand and resistance to bio-degradation on account of having complex aromatic structures. For this purpose, dyes in waste water are either removed by adsorption or degraded by photo-catalysis. In this area, semiconductor materials have attracted much attention. Among semiconductors, TiO_2 is considered a bench mark photo-catalyst for dye degradation. This is because of having high efficiency, low cost, chemical corrosion inertness, and long-term stability against photo-corrosion and chemical corrosion. Moreover, it is a photosensitive material, possesses high photo-catalytic activity, is stable in aqueous systems and has low environmental toxicity [1].But the major shortcoming to the use of TiO_2 photo-catalysts lies in having low quantum efficiency and the confined utilization of sunlight. For a material to exhibit high photo-catalytic activity, it must be porous and possess high surface to volume ratio so as to lead increased adsorption of dye. The high surface to volume ratio (surface area) can be attained provided the material to be either highly porous or nano-sized. This is the reason that benchmark TiO_2 photo-catalyst has been found to be less efficient than nano-sized TiO_2.The material must exhibit slower

recombination rate of photo-generated electron-hole pairs. This will help to cause facile degradation of dyes. ZnO was found to have almost same band gap energy as that of TiO_2, hence it was anticipated to be a better alternative for TiO_2 photo-catalysts, but the fast recombination rate of photo-generated charge carriers limits its applicability. Reduction in the recombination rate can be attained by forming hetero-junctions between different components. This is indicative of making a composite material. However, this would demand a proximal interface contact.Moreover, materials with wider absorption range lead to enhanced efficiency in the degradation of dyes. For such a factor, TiO_2 again has limited applicability as it absorbs only a small portion of UV light. Thus to widen its absorption band spectrum, doping, composite science and the formation of hetero-junctions is essential.All the factors discussed above are complementary to one another. This we mean to say that a material with high surface to volume ratio does not suffice to be a good photo-catalyst unless other factors are more or less favoring. This demands the balance in the properties of materials desirable for photo-catalysis [2-5].

Mechanism Of Action And The Development Of Systems

The mechanism of dye degradation involves the excitation of electrons from valence band (VB) to conduction band (CB) of the material by light irradiation. Due to this excitation, a vacancy is created in valence band called as hole. As the dye solutions are aqueous, holes produced in valence band trap water (H_2O) molecules to generate $^\bullet OH$ radicals while the electron in conduction band get trapped by the preadsorbed O_2 molecules thereby leading to superoxide ($O_2^{\bullet -}$) radicals which would react with protons to generate $^\bullet OH$ radicals. These radicals, since having strong oxidizing activity, then interact with dye molecules for causing their degradation into CO_2 and H_2O molecules which are environmentally benign [6].
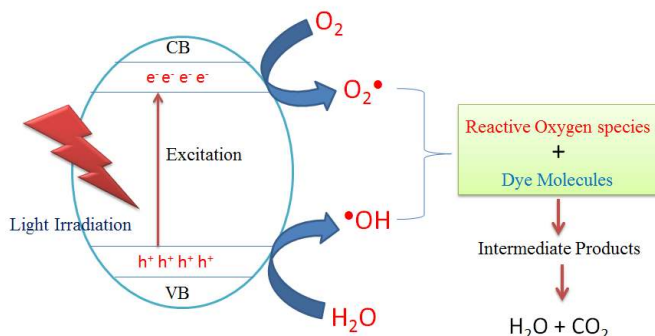
The presence of reactive oxygen species (ROS) for the degradation of dyes and hence the mechanism of degradation is normally proved by adding radical scavengers such as disodium salt of EDTA (EDTA-Na_2) and t-butyl alcohol. Their addition to the reaction mixture leads to the scavenging of such ROS thereby causinga reduced efficiency of dye degradation.

It has been observed that single walled titania (TiO$_2$) nanotubes are less efficient to cause dye (Methylene Blue) degradation under UV-light than double walled titania. This has been attributed to the greater surface area of later [7]. To enhance the separation of photo-induced charges and to reduce the rate of recombination, Bi$_2$O$_3$ has been coupled with BaTiO$_3$. The resulting hetero-junction was found to have an efficient interfacial contact, owing to which the photo-catalytic degradation of Rhodamine-B (RhB) has been enhanced to around 60% than pristine samples [8].ZnO microspheres have been coupled with CuInS$_2$ and CuInSe$_2$. It has been observed that ZnO/CuInS$_2$ is having more photo-catalytic efficiency to degrade RhB dye as compared to ZnO/CuInSe$_2$ hetero-junction. This has been ascribed to the large surface area of former owing to small size. Moreover a high value of degradation efficiency has been achieved with ZnO/CuInS$_2$/ CuInSe$_2$ system as shown in Fig.1. This is because of the formation of double hetero-junctions which lead to greater absorption of light and prevents effectively the recombination of electron-hole pairs [9].

In addition to the development of above hetero-junctions,conducting polymer based nanocomposite photo-catalysts have attracted much attention. For instance, many metal complexes form nano-composites with conducting polymers like polythiophene (PTh), Polyaniline (PANI) etc. PTh/[Fe(CN)$_3$(NO)(bpy)] 4H$_2$O nanocomposite fibers have been found to exhibit enhanced photo-catalytic activity. The main contributing factor for enhanced activity has been ascribed to the proximal interface contact as the surface area of such a sample has not impressed much. The proximal interface contact between [Fe(CN)$_3$(NO)(bpy)] 4H$_2$O and PTh has been justified by photoluminescence (PL) measurements. For the identification of ROS, scavangers like EDTA-Na$_2$ and t-butyl alcohol have been used that lead to reduced methyl orange (MO) dye degradation as shown in Fig. 2 [10].
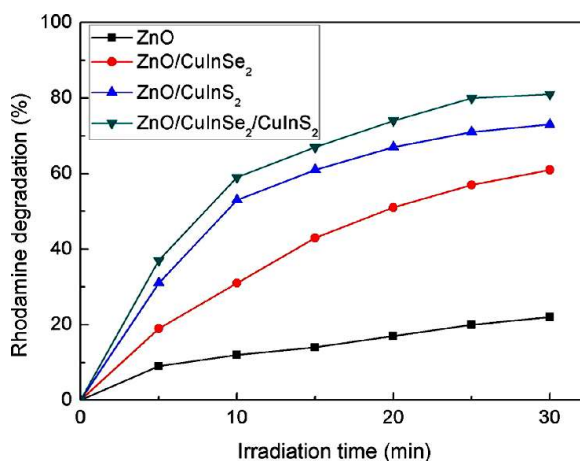
Fig.1. Photo-catalytic degradation kinetics of RB aqueous solution with an addition of ZnO microspheres, ZnO/CuInSe$_2$ (with mass ratio of 5:1) hetero-junction photo-catalyst,

ZnO/CuInSe$_2$ (with mass ratio of 5:1) hetero-junction photo-catalyst, and ZnO/CuInSe$_2$/CuInS$_2$ (with mass ratio of 10:1:1) double hetero-junctions photo-catalyst.
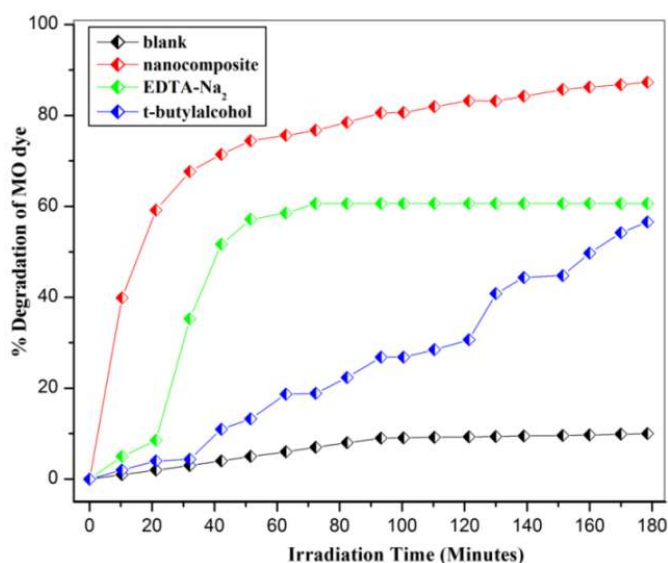
Fig.2. Dye degradation of nanocomposite and nanocomposite in the presence of scavengers

Conclusion

Water treatment is a necessity inorder to minimize the scarcity of water and to avoid environmental contamination from the textile industries. The understanding of eco-friendly materials as photocatalysts by which environmental remediation can occur has been assessed. The factors responsible for the enhancement or reduction in the degradation of dyes have been taken into consideration.

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Spectacle, State of Exception and Right to the City: Mumbai Docklands Redevelopment

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Abstract: This paper tries to bring together apparently three different concepts in urban studiesand theory, i.e. 'Spectacle' (Guy Debord), 'State of Exception' (Agamben) and 'Right to the City' (Harvey, Lefebvre) into a trialectic relationship. I argue, using the example of Mumbai Docklands Redevelopment that, spectacular mega-urban development projects are imagined, articulated and executed in a politico-legal state of exception, wherein democratic and legal mechanisms of urban governance are suspended in favour of crystallization of urban capital as spectacle. As a consequence, I try to show that the idea of 'Right to the City' becomes impossible for the urban masses, especially urban poor, to exercise, and that, we might have to rethink Lefebvre's and Harvey's theorization of the same in the light of emergent spectacular urban development.

Introduction

Urbanization, i.e. production of urban space, is a primary means of survival of capitalism (Lefebvre, 1976a). It is a striking example of spatialization of capitalist modernity (Soja, 1989). This production of space manifests itself in the large scale urban development projects. Contemporary discourse of 'world (class) cities' or 'global cities' insists on large scale urban development projects (Swyngedouw, 2002) as a necessity of sorts, with which to revive the 'sick and the declining' regions of the city on one hand, and to be integrated into the 'world-city system' on the other.

The space produced in such a context, can also be read as intensification of capital as spectacle. In other words, urban is the mode of capitalist production of space which facilitates the realization of spectacle. Bringing together Lefebvre's notion of capitalist production of urban space and Debord's idea of high degree of capital accumulation becoming an image, i.e. a spectacle (Debord, 1994); I intend to establish the urban development projects of large scale as cases of spectacular urbanism, a phenomenon which is driven by the absolute presence of image. Such a discourse envisions the city or urban condition as a spectacle, an image, a representation,

referring in turn to the spectacular quality of the major global cities of the world like New York, London, Shanghai, etc. These cities have dominated the urban imagination throughout the world by a specific imagery associated with each of them (whether skylines, symbolic value of the urban objects or hyper-real spaces of corporate office towers). This domination of the urban development discourse by the notion of spectacle and image leaves very little scope and possibility for the urban life lived in its spontaneity and immediacy. In fact such conceptions and imaginations of future urban conditions which are dominated by spectacle are antagonistic to the realization of urbanity that Lefebvre considered to be the real emancipatory spirit of urban (Merrifield, 2006).

Going further, I argue that such urban development projects, which are conceived as spectacular – divorced from the lived reality on the ground – are brought to presence under a 'state of exception' (Agamben, 2005), often deemed 'necessary' for the very survival of the city in crisis (Porter, 2014). This in turn complicates the possibilities of all grass root politics and working class movements (which for Lefebvre are crucial in determining the 'urbanity', the difference), and in turn the possibilities of 'right to the city'.

Mumbai Docklands Redevelopment

Urgency about the complete integration of the city into the capitalist world economy can be encountered in Mumbai. Such urgency is often manifests itself in the grand urban visions which will transform the landscapes of poverty and informality into global spaces of affluence and urban spectacle. Redevelopment of Mumbai Docklands as a case study offers an excellent opportunity to analyse and understand the urban (re)development projects as coming together of 'spectacle as a 'state of exception'' and its role in complicating the notion of 'Right to the city'. Mumbai docklands are 752.7 Ha of 'derelict' industrial lands along the Eastern shore which houses various estates, Mumbai Port Trust (MbPT) staff quarters, docks and storage facilities, housing estates, apart from the informal residents and workers who find employment at ship-breaking yards, scrap yards, warehouses, etc. The existing situation is therefore of a large number of people for whom the docklands are still a source of income and residence, and who would be directly affected by any kind of transformation (Indorewala, 2015).

The state has for long been trying to 'unlock' the land, and release it for development and monetization. Given its very high economic potential, the discourse of economic regeneration has always been presented as a necessity, without taking into consideration the existing complexities and textures of the site, assuming it to be a greenfield development. The setting up of Mumbai Portland Development Committee (MPLDC) in 2014 by the Union government for envisioning the future of the docklands had 'tourism' and 'recreation' as it guiding themes (Indorewala, 2015). This argument for transforming the 'sick and derelict region' of the aspiring world class megacity often involves tourism, recreation and culture industry as the curative

strategies, which would be instrumental in pushing forth and consequently, announcing the arrival of Mumbai onto the global stage, competing with the cities like Shanghai (Mumbai Govt vows to be next Shanghai, 2005). This phenomenon of integrating the cities of Global South has elsewhere (perhaps in a different academic context) been called 'worlding of the cities' (Roy & Ong, 2011).

In context of the Mumbai Docklands, the case for redevelopment was taken up in2014 again by the Shipping Minister (after 12 years). The language used for making the case for regeneration of the docklands contains phrases like "Mumbai's last big chance" (Chandrashekhar, 2014), "re-imagine the city itself…" and the images invoked range from 'floating hotels (Dubai), Ferris Wheel (London) (Scroll.in, 2015).

The entire framework of proposals for the docklands have been imagined and worked out in terms of image and fantasy, of Mumbai as a global city, with its recreation parks, museums, galleries, hotels and convention centers; matching the spectacular, photogenic urban views and landscapes of cities like New York, Shanghai, Dubai, etc. The architectural renderings and the opinions of various experts involved with regeneration project are loaded with imagery that is common to landscapes of affluence and corporate finance (Chandrashekhar, 2014). This in turn creates a discourse of spectacle which conceals within itself the deeper splits and divisions in the city of Mumbai in terms of class, i.e. between the poor and the ultra rich. 42.6% of households in Mumbai live in "housing poverty", i.e. unacceptable physical and social conditions (Kundu, 2012).

It is in the nature of the spectacle to conceal such divisions and splits and perpetuate the dominance of ruling class (Debord, 1994). Such spectacles, as imagined in case of Mumbai docklands redevelopment, are the sweeping visions of the city imagined as the spaces of consumption like tourism, recreation, culture industry, etc; which rob it of its working class spontaneity andpolitical activism (Lefebvre, 1996).

Such visions of city, which forcefully transform it within the systems of capitalist political economy, marginalize and condemn the poor to the gaps of the city, from where they merely negotiate their basic rights to services like water and shelter (leaving the notion of 'Right to the city' as Lefebvre and Harvey meant it, impossible to appropriate and exercise). Such negotiations and mobilizations on part of the poor, especially in context of Mumbai, have been lately looked upon positively, and even celebrated and romanticized as 'deeply democratic' (Appadurai, 2001) and 'subaltern agencies of change' (Roy, , 2011). Invoking Soja (Soja, 1995), I argue that such romanticizing makes us blind to the larger picture, 'the macro view' of the political economy of the capitalist transformation of city; and such romanticizing also attacks at the very root of what Lefebvre considered the 'urbanity' offered by the city.

Spectacular Urban Development as a State of Exception

Agamben defines 'State of Exception' (Agamben, 2005) as a suspension of the rule of law. I argue that, case of spectacularly large urban development projects, which are formulated and advertised as a 'necessity' (Porter, 2014), is an example of a variant of 'state of exception' atthe level of urban planning and governance (Baptista, 2013). Spectacle, as a concentrated capital, asks for governance as a technique to ensure imposition of a 'state of exception' for its own realization (Debord, 1994). Such technique of governance already assumes a subject, the urban poor who currently inhabits the future space of urban spectacle (Schinkel & van den Berg, 2011) and is thus an impediment towards the realization of the spectacle. In case of Mumbai, the subject of such governance is the slum dweller and informal workers who areliving in the various quarters of the docklands. The governance therefore works against the subjects under this state of 'crisis', 'emergency' and hence 'necessity', reducing them to 'bare life', by demolishing their shelters and workspaces and snatching their livelihoods. Such procedures witness the suspension of all planning legislation and procedures which involve community participation, relocation and compensation. The violation of legislation as a 'state of exception' has already been experienced by the poor of Mumbai, during the redevelopment of textile mills, which ended up completely driven by private and commercial interests, leaving the poor and the original stakeholders no claim to the redeveloped space (Scroll.in, 2015). Such suspension of legality in terms of democratic community participation, as a legal right in all urban development and redevelopment, and violation of socialcontract between the citizen and the city government, has been the (hi)story of all redevelopment and regeneration which had spectacular realization as its objective, whether Hausmannization of Paris (Harvey, 2010) or redevelopment of London Dockyards (Fainstein, 2001).

Such trends of state of exception as necessity may be repeated, in fact has already been established as 'norm' in case of Mumbai. The redevelopment of Mumbai docklands is argued for as an emergency, given the crisis of Mumbai in terms of housing and open spaces, but at the same time it is being imagined and presented as a spectacle proper. The people, against whom the discourse of spectacle works, i.e. the urban poor, end up as being the 'passive spectators, observing their own exploitation' (Pinder 2000).

Right to the city

The urban redevelopment as a 'state of exception' thus renders null and void any claim of the poor and vulnerable, i.e. those who cannot arrive on the circuit of consumption, and therefore cannot contribute to the intensification of capital as spectacle. Such a predicament complicates Lefebvre's notion of the 'right to the city'. I argue that 'Right to the city' cannot be possibly exercised in a constantly transforming 'city as a spectacle' which perpetuates the 'state of exception'. Right to the city is a legitimate right to the urban life which can only be exercised

within the rule of law, and is rendered meaningless under a 'state of exception' which suspends the law, and hence the source of all legitimacy.

In case of Mumbai, the spectacle and the state of exception within which it is conceived has already suspended the planning legislation and started bulldozing the houses and workplaces of informal workers who have been living on the docklands ever since, making it impossible for the poor to exercise any right to the city. The ambiguity in the language of MPLDC recommendations, fundamentalism of economic sustainability (rate of returns, etc), privileging of private capital in regenerating the docklands, leave the urban poor and the people dependent on the welfare schemes of the MbPT, outside the regeneration model. Their claims cannot be democratically incorporated, since the planning functions of the MbPT will be given to a 'Special Planning Authority' called Mumbai Portland Development Authority (MPLDA), which would not be democratically constituted. In fact, as 'Special Planning Authority', it will be constituted to bye-pass the democratic process. MPLDA as a planning authority would therefore operate as a 'state of exception' within which the poor of Mumbai cannot exercise a legitimate right to the city (Indorewala, 2015).

Conclusion

Such a predicament, where the notion of 'Right to the City' cannot be exercised at all, was perhaps foreseen by Lefebvre early in his writings, but he only made it explicit in one of his last brief essays, wherein he explains 'right to the city' as 'implying nothing less than a revolutionary concept of citizenship' (Lefebvre, 2014). It remains a task to interrogate Lefebvre's 'revolutionary concept of citizenship' and delineate its contours in terms of political praxis.

Hafeez Contractor's idea of what the Mumbai port land development should look like, including the world's tallest building

The master plan for Hafeez Contractor's proposal regarding the Mumbai docklands development

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IRD: Inter-cloud Resource Discovery

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Abstract: Several P2P based resource discovery schemes have been proposed by researchers but achieving effective and secure resource discovery in the inter-cloud remains significant. Most of the existing approaches lack efficient peer-selection, trust/reputation management, transaction record management and financial settlements. In this paper, we propose P2P-based conceptual decentralized inter-cloud resource discovery model using Hyperledger blockchain platform which is capable of addressing several of the key shortcomings of existing approaches. It is the first illustration of applying the blockchain concept to the inter-cloud resource discovery process sidestepping the need of a trusted third-party or broker between participating Cloud Service Providers (CSPs).

Key words: *inter-cloud; resource discovery; blockchain*

Introduction

Discovering and managing resources in an inter-cloud environment is usually done in either centralized or decentralized manner. The existing techniques of resource discovery in inter-cloud [1][2] suffer from issues like single-point-of-failure, performance vs. scalability and ensuring up-to-date resource availability information. CSPs participating in inter-cloud environment look up for the available resources which further require that resource availability information should be correct and up-to-date. Each CSP contains multiple data centres that are geographically dispersed and hence latency can become major bottleneck in effective resource discovery. An efficient resource discovery strategy for the inter-cloud environment should also attempt to minimize the communication latency by taking into account the geographical location of the CSPs [3]. Many P2P-based resource discovery mechanisms[3][4][5] along with GICTF[6] industry body have suggested work in this area but one of the major challenge with these decentralized approaches is the lack of a trusted-third party for maintaining non-repudiable records of resource sharing agreements, actual resources provisioned or consumed and finally financial commitments of engaging CSPs. Security is also the major challenge in inter-cloud and hence organizing fool-proof identities, assuring non-repudiation and securing end-to-end communication channels are important in inter-cloud.

The proposed IRD model encompasses a fully decentralized P2P network of participating CSPs with associated protocols for facilitating efficient resource discovery and the innovative use of blockchain [7][8] as a trusted ledger for maintaining transactional records. Thus, the need of a centralized authority in existing inter-cloud resource discovery frameworks is alleviated.

Without any centralized authority, multiple CSPs arrive at a consensus which is recorded in the ledger for the future reference ensuring immutability and transparency. Further, time stamped transactions enable CSPs to track resources advertised by other CSPs, make optimal resource discovery/selection and build trusted relationships leading to a more secure ecosystem. This helps in overcoming major shortcomings in existing P2P-based resource discovery schemes i.e. the need for a central trusted third-party for financial settlements and security concerns including single-point-of-failure of the trusted third-party and the presence of malicious peers in non-federated inter-cloud models.

In this paper we have used the concepts of Hyperledger Blockchain[9] to propose a conceptual model for inter-cloud resource discovery.

Background Work

Despite the numerous benefits provided by inter-cloud, resource discovery remains a challenging issue, yet imperative task to identify and select the most appropriate set of resources to host cloud applications. Resource discovery process is considered to be critical for efficient resource allocation and management. Not many mechanisms pertaining to resource discovery in inter-cloud environment have been proposed by different researchers in literature. Table1 broadly classifies the some of the resource discovery approaches and presents the work done by researchers and industry bodies in the field of resource discovery within the inter-cloud environment.

RESOURCE DISCOVERY APPROACHES & DESCRIPTION	
Market-Based Negotiation Model[1][2]	Emphasizes on federated clouds with resource discovery based on negotiation which is held in a centralized exchange. Proposed work is prone to single point of failure and presents scalability issues.
Meta-Computing Scheduling Architecture(NWIRE)[10]	Focus is on brokerage and training and is a market system between sub-domains. Provides high degree of flexibility.
SMI Cloud Framework[11]	Customers can evaluate cloud offerings and rank them based on their ability to meet the user's QoS requirements. Ranking algorithm used is in-efficient to cope with variation in QoS attributes such as performance, reliability etc.
C2C Framework[4]	P2P-based market ecosystem facilitating resource sharing across CSPs and provides greater elasticity and caters to volatile resource requests. Simplifying assumptions in the model can create complexities into the model requiring end-of-day settlements with multiple CSPs.

P2P-Based Distributed Resource Discovery[3]	Mechanism based on spatial-awareness of cloud data centres belonging to different CSPs providing minimum response time. Approach is silent about QoS parameters like availability, reputation etc. for service discovery and selection mechanism.
Chord Based Resource Discovery[5]	Chord-based P2P distributed resource discovery mechanism based on spatial-awareness of cloud data-centres belonging to different CSPs. Elements of Trust and Reputation by participating data centres are not discussed.
FIDDLE: Semantic Information Model[12]	Formally explains federation including infrastructure and life-cycle of the offered resources and services. Underlying concept described is currently in the process of being refined and standardized by an international consortium that is independent of specific research projects or products.
Cloudle[13]	Agent based search engine for supporting cloud service discovery, service negotiation and service composition.
GICTF[6]	Global Inter-Cloud Technology Forum (GICTF) an inter-cloud forum explains resource discovery based on collection of resources and their selection by a central entity. Supports both centralized and P2P approaches.
Cisco Inter-cloud Fabric[14]	Build highly secure hybrid clouds and extend existing data centre to public clouds as needed, on demand, and with reliable network and security policies.

Table 1: Literature Review

System Model

Figure 1 provides a detailed schematic of proposed framework with integrated blockchain for discovering resources efficiently and securely within the inter-cloud environment. The P2P federation of CSPs such as CSP_A, CSP_B and CSP_C as shown in the diagram maintains a decentralized and distributed copy of the inter-cloud ledger (IC Ledger) that records the series of transactions which take place between various cloud service providers. Each CSP contains various data centre (DC1, DC2, DC3 .....DCN) located at various geographical locations for handling the resource requests within the CSPs. There are broadly two kinds of resource classifications within the framework; Resource Advertisement (R_a) broadcast by the CSPs for sharing resources with other CSPs over the P2P network, Resource Requests (R_r) broadcast by the CSPs desirous of availing resources from the other CSPs within the network.

The IC Ledger maintained at each CSP records time-stamped and encrypted transactions along with the trust/reputation and QoS index information which can help various CSPs to securely track resources advertised by other peer nodes and make optimal resource discovery and selection choices. The use of blockchain also solves related security issues such as authentication, ensuring non-repudiation and data immutability.

A. Preliminaries

- Each CSP maintains the state and copy of the ledger containing all the transactions between the CSPs.
- The CSP can play a dual role of either being an *Endorser-CSP (E-CSP)* or *Orderer-CSP (O-CSP)*. Endorser-CSP endorses the transaction deals (B2B-transactions) and does verification before they are added to each individual CSP ledger. Orderer-CSPs maintain the order of transactions and combine them according to particular instance of time into a block to be added onto the ledger.

- Resource advertisements (R_a) and Resource requests ($R_{r)}$ initiated by the CSPs need to be properly endorsed.
- *Endorsement policy* is defined for the network that provides the set of Endorser-CSPs required to endorse the R_a and R_r. Endorsement policies are used to instruct a peer on how to decide whether a transaction is properly endorsed.
  - *Smart contracts* that directly control the transfer of assets/resources between parties under certain conditions are written in the form of *chaincodes*. They define the business logic of B2B transactions and are deployed over the P2P-network that controls the transfer of resources between CSPs only when certain criteria's are met.
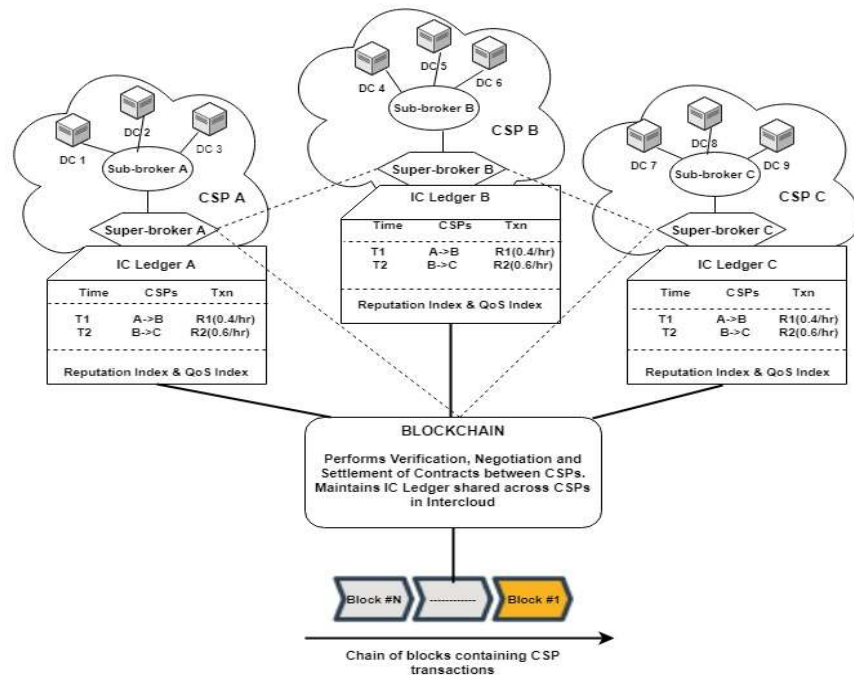
Fig. 1. Conceptual Representation of Inter-cloud Resource Discovery Framework

B. Sequence of Operations

1. CSPs consist of multiple data centres dispersed at different geographical locations. There is a central sub-broker within each CSP to handle the internal resource provisioning. Each CSP has a super-broker which is used to keep track of resource information from other participating CSPs. It is these super-brokers that participate in P2P blockchain network maintaining a copy of distributed ledger that records resource transactions.

2. Data-centres belonging to various CSPs publish the Resource Advertisements (R_a) or Resource Requests (R_r) in the form of PROPOSE message to set of Endorser-CSP. Cloud service providers acting as Endorsers endorse these transactions before they are committed and added to the ledger maintained within each respective CSP. The Resource Advertisements and Resource Requests are usually represented as 2-tuple such that;

   $R_a/R_r = <$ PROPOSE, Transaction (Txn) $>$

   where,

   Txn $= <$ CSP_ID, chaincodeID, R_o/R_r, C (Cmin, Cmax), R_I, Q_I, timestamp, CSP_sig $>$

   - CSP_ID is an ID of the CSP publishing the R_a or R_r
   - chaincodeID refers to the smart contract or business logic for B2B transactions
   - R_a/R_r are the resource advertisements/requests (usually in the form of VMs) issued by CSPs
   - C is the associated price/cost-value of resources offered or requested by CSPs and can include minimum and maximum values.
   - R_I is the aggregated reputation index associated with the CSP
   - Q_I is the aggregated quality-of-service index of the CSP
   - Timestamp is a monotonically increasing integer maintained by CSP
   - CSP_sig is the signature of CSP attached with the PROPOSE message since each operation needs to be cryptographically secured

3. The R_a/R_r offered or requested by CSPs recorded as transactions have an associated time-to-live (TTL) parameter so that if the allotted time expires, the transactions can be discarded and only the latest information is disseminated and acted upon.

4. CSPs can decide on the interaction with Endorser-CSPs for verification of their transactions depending upon the Endorsement Policy which is defined in the chaincode for a network. Endorsement Policy is usually defined as 2-tuple which is expressed as;

< principal, threshold gate> or symbolically represented as <p, T>

where,

p = CSP whose signature is required for verification of transaction

T = <t, n> where t is the threshold number and n is the list of principal ENDORSERS

For instance, if there are 5 CSPs within the P2P network then Endorsement Policy defined as T (2, 'CSP A', 'CSP B', 'CSP C', 'CSP D', 'CSP E') requires a signature/verification from any two principal CSPs out of five CSPs.

5. On receiving Ra/Rr in the form of PROPOSE message, the Endorser-CSPs take the ownership of verifying Ra/Rr. The main objective of ENDORSER-CSP (E-CSP) is to verify:

- whether the PROPOSE message is properly signed by the CSP

- whether the CSP offering resources has the requisite number of resources offered.

- whether cost advertised by CSP is affordable or not?

- what is the reputation index RI attached with CSP?

- what is the QoS index associated with advertising CSP?

6. Once the CSP-transactions are verified by the Endorser-CSPs and all the nodes reach common consensus, a message in the form of,

<TRANSACTION-ENDORSED, transaction-proposal, epSig> is sent back to the CSPs forwarding the R_a/R_r;

where,

tran-proposal = includes the transaction related information

epsig = endorsing CSP's signature.

Otherwise,

<TRANSACTION-INVALID, transaction-proposal, REJECTED> is sent back to CSPs.

7. Transaction-proposal responses are then inspected by issuing CSPs who try to match the signatures from the set of Endorser-CSPs according to the endorsement policy. If all the responses are same, the requesting CSP will enter into negotiation with the CSPs whose resource transactions are verified and meet the criteria.

8. Once the deals are finalized CSPs then 'broadcasts' the transaction-proposal to Ordering Service or Orderer-CSPs. Orderer does not further verify the responses received from CSPs but simply chronologically orders them, checks if the endorsement policy is fulfilled and creates a block of transactions per network. Each block includes cryptographically secured hashed value, a time-stamp and hash-pointer of the previous block generated linking the two blocks as shown in figure 2.
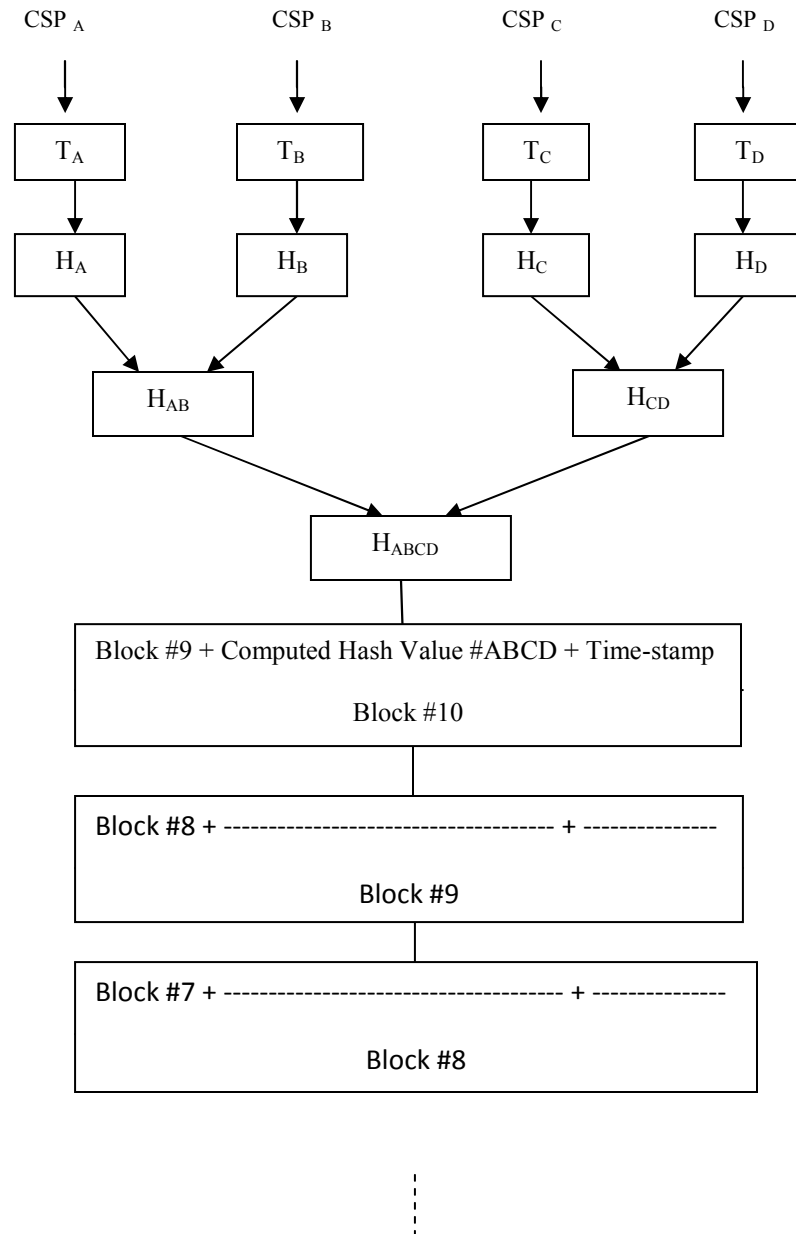
Fig. 2. Addition of new Block in Blockchain

9. Final deals are combined into a new block of valid and confirmed transactions and hence flooded over the network to all CSPs connected. Newly created blocks of valid transactions between CSP-CSP are hence added to the previously generated chain of transactions that are maintained in the form of a ledger at all CSPs connected in a P2P fashion.

For clarity, a unified sequence diagram for inter-cloud resource discovery framework using blockchain is shown in figure 3 explaining the major operations in CSP-CSP interaction.
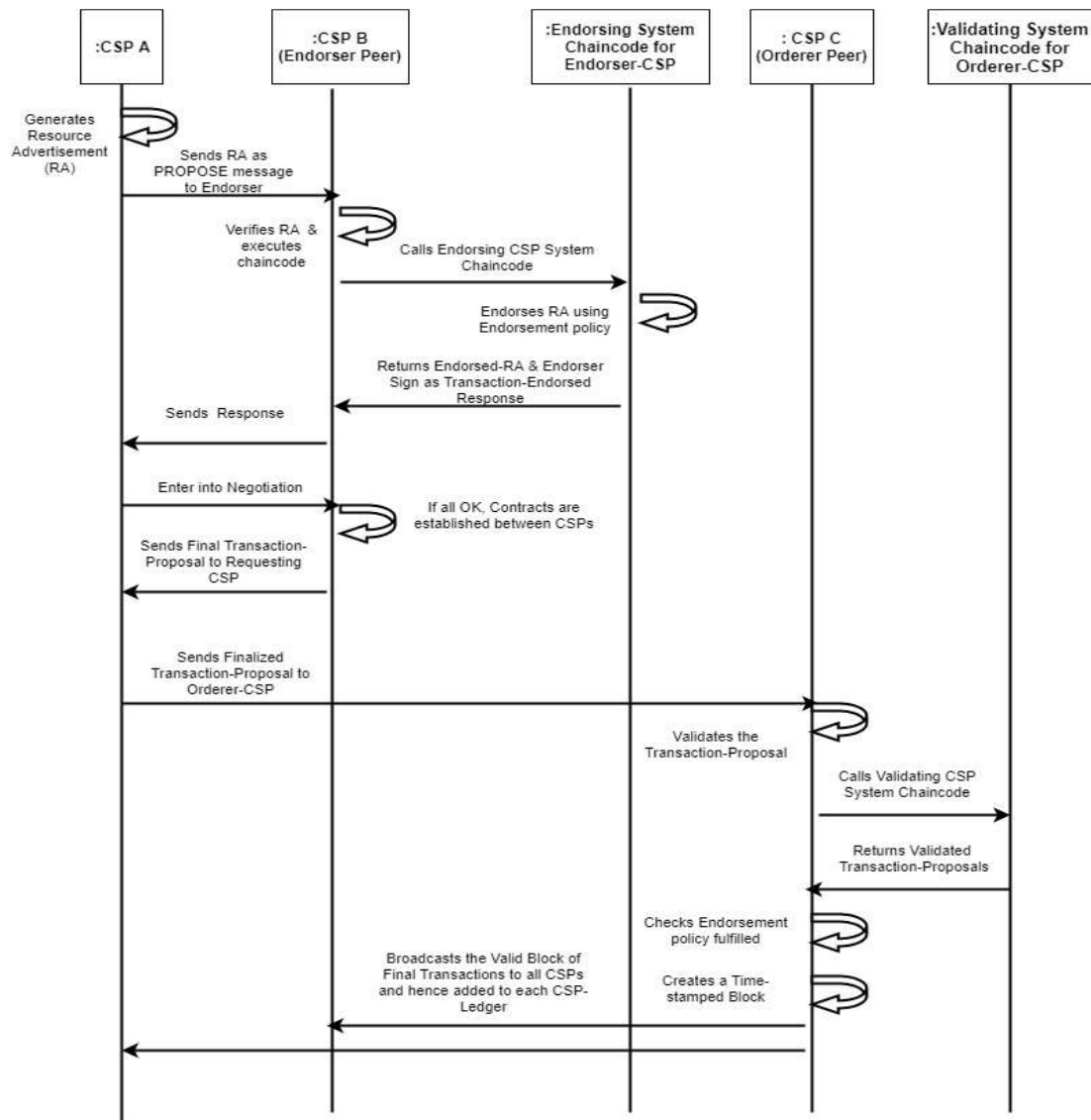
Fig. 3. A conceptual unified sequence diagram for inter-cloud resource discovery model using Hyperledger Blockchain

Simulation Results

Early results have been generated implementing a custom simulator using Java for the proposed system model. In this model we have considered a maximum of 100 CSPs participating in a federated structure and which are geographically dispersed. Global latency measurements from AT&T [15] are used to model real-world latencies and communication overheads between different CSPs. Hyperledger Fabric has been used to check the performance of the model to figure out the number of resource requests that are validated and committed by the CSPs (endorser-CSPs and orderer-CSPs) to optimize the maximum throughput. However, the number of endorsers, and orderers required to process the resource requests/ advertisements in the form of transactions depends upon the endorsement policy. The choice of the number of nodes (endorsers/orderers) in geographically dispersed inter-cloud is important. Figure 4 provides the average transactions processed as a function increasing number of nodes.
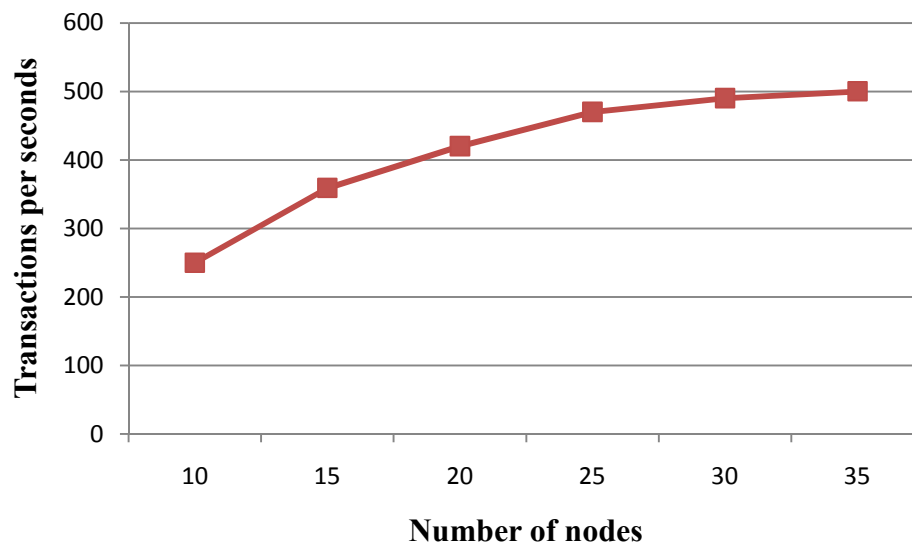
Fig. 4. Average transactions processed by varying number of nodes.

As we can see from the figure above that the throughput increases initially but starts flattening thereafter since too many nodes will result in greater coordination complexity and overheads.

Conclusion & Future Work

This paper presents a conceptual framework using the concepts of Hyperledger blockchain for discovering resources efficiently and securely in within inter-cloud environment. The application of P2P strategies for resource discovery in the inter-cloud environment finds few references in literature. However, with the use of distributed and decentralized P2P platform like Hyperledger,

peer nodes can effectively and efficiently discover and select resources. The proposed framework claims to offer the following advantages:

- Transparency and trust amongst CSPs since each CSP can verify resource information.
- Security as all the transactions in Hyperledger blockchain is cryptographically secured.
- Immutability and non-repudiation as the transactional record once written on shared ledger of CSPs cannot be modified.
- Low cost as no third-party is involved and hence eliminates overhead costs

Future work shall include real-world implementation using Hyperledger blockchain to prospect the trade-offs and performance in a federated setup. Experimenting with different block-sizes, speeding-up validation and commit processes in network of CSPs while minimizing latency will be the focal point.

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Energy Evaluation of Sensor Protocols Based on Artificial Neural Network Approach

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Abstract: Wireless sensor networks (WSNs) have garnered significant research attention due to their exclusive characteristics like extensive ability to sense the physical world phenomenon and their applicability to an extensive range of applications, wide range of applications cheap in cost and highly reliable. One of major constraint of WSN is lifetime of network as due to it is equipped with batteries. To resolve this problem to some extent is done by developing energy-aware routing algorithms. Moreover, these energy-aware algorithms are an attempt to balance the energy and reduce the transmission power required by sensor nodes. In this paper, EESR-ART2 approach is an attempt to make network energy efficient. ART-2 technique is implemented with energy efficient sensor routing (EESR) protocol that found to be a much effective results in simulation and enhance the network lifetime in terms of FND (first node dead) and HNA (half network alive) as compared to other protocols.

Keywords: *EESR; ART-2 neural network; LEACH; energy efficiency.*

Introduction

Wireless Sensor Network (WSN) deals with advanced technologies, automation systems and industrial projects. Wireless Sensor Network provides sensed information in automated form at very low cost as compared to other technologies. It is only done after the invention of eminent advancement in electronic circuitry by developing micro-electromechanical system (MEMS). MEMS technology made sensor network small in size and enhanced the sensing capabilities and reduced the cost at a greater extent. Due to advancement in sensor technologies; capabilities of individual sensor are also flourished. As WSNs have a high range of real world applications, so it can easily be expanded from few hundred to thousands of sensor nodes in number. It can easily be deployed due to property of self-configurable and self manageable.

WSN comprises plenty of homogeneous sensor nodes i.e similar type of memory, hardware and software configuration. It has a wide range of applications like weather forecasting, battle-field tracking, chemical industries for chemical fume analysis, hospitals for patient monitoring etc [1]. It is normally deployed in harsh environment where human intervention is negligible. As application perspective of each WSN has its own design and routing issues. Each WSN scenarios are dependent on the actual required capabilities of sensor nodes. Sensor nodes are generally

taken as homogenous in nature but it may be heterogeneous. Even though different environment might contain different issues but a common issue has always emerged in every WSN implemented scenarios that should be resolved as much as it can be. That issue is energy consumption of WSN. This should be lower in terms of overall network lifetime. There are a lot of routing techniques have been designed to reduce the energy consumption and made the WSN energy efficient as much as it could be. But still there is need of a lot of research work over routing protocols to make the WSN energy efficient [17], [18].

One of the major challenges of WSN is energy consumption. In this paper, an analysis of energy parameter on various routing protocols based on artificial neural network approach. In section 3, EESR protocol is discussed. The problem statement is described in section 4. The architecture of ART-2 neural network is explained in section 5. Experimental results are analyzed in section 6.

Related Work

Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol [3-4] is one of the popular hierarchical protocols based on clustering. Basically, LEACH protocol is to manage some cluster-heads (CHs) nodes from the plenty of sensor nodes. These CH nodes are selected on the basis of various parameters like remaining energy, concentration of sensor nodes, vicinity of sensor nodes etc. The rest nodes act as non-cluster head nodes which are data senders to CH nodes. All non-cluster head nodes send their data to their particular selected CH node in particular time slot specified by every CH node. LEACH [5] is featured with TDMA (Time division multiple access) MAC protocol. The task of CH nodes are to aggregate the sensed data and forwards to sink node directly if it is 1-hop far otherwise via intermediate nodes that will act as routers for the sender node. The energy consumption of CH nodes at higher range as it deals with aggregation of data as well as data transmission to sink nodes. After this cluster head rotation operation is implemented; to compensate an energy reduction of CH node and select CH node for another round from all non-cluster head node list. As this effort was enough for the particular scenario, but today's environment is totally different as a wide range of application has exists but still need a more effective routing protocol.

Power-Efficient Gathering in Sensor Information Systems (PEGASIS) protocol has introduced. S. Lindsey et al. in paper [6] proposed a new chain-based protocol called PEGASIS. PEGASIS protocol has designed to focus on energy saving parameter so that overall network lifetime increases. PEGASIS protocol considers two objectives: one is to enhance the lifetime of each node on the basis of collaborative technique. Other is neighboring nodes those are nearest should allowed for communication that will reduce bandwidth consumption. In this protocol, it does not follow clustering scheme. PEGASIS, coordinates with nearest nodes, it uses signal strength to calculate the distance among all the neighboring nodes and adjusts the signal strength so that only one node is able to hear. The chain of PEGASIS will consist of only those nodes that are nearest to each other on the basis of signal strength and follow a path to BS. The aggregated sensed data will send to BS by any node present in a chain. The chain construction is performed

in greedy fashion. PEGASIS performs two times better than LEACH in simulation results. Better performance is obtained due to elimination of overhead by dynamic cluster formation in LEACH and decreasing the number of transmission and reception by using data aggregation.

After successful design of PEGASIS routing protocol; this was based on chain construction in greedy fashion. Furthermore, need of protocol based on energy saving parameter so an EESR (Energy–Efficient Sensor Routing) has proposed. EESR protocol [7] works efficient for densely deployed sensor networks. In this routing algorithm, there consists of a gateway, a base station, manager nodes, and a number of sensor nodes. The gateways transferred commands received from a manager to the base station and controls messages received from base station. The gateway directs command to base station then after base station orders queries to sensor nodes. Base station aggregates data from sensor nodes and delivers control messages to the gateway.

LEACH-ART protocol has proposed in paper [8]. In this protocol, LEACH protocol has been modified by the authors with the help of ART-1 neural network. As LEACH protocol is hierarchical based protocol. Cluster heads are selected based on remaining energy parameter with the help of ART-1 neural network [9]. In the protocol two lists are maintained. One for cluster head selection and another for non-cluster head selection. In every round of CH selection, both lists are scrutinized by ART-1 neural network and select the CH nodes. As it consumes energy for scrutinizing process by ART-1 neural network but the overall network lifetime is enhanced at greater extent with lower and higher vigilance parametric evaluation in comparison to LEACH protocol in terms of first node dead, half network alive and last node dead.

EESR-ART protocol has proposed in paper [10]. EESR protocol is modified by authors with the help of ART-1 neural network. As EESR protocol performed better than LEACH protocol, authors has expected to enhance network lifetime to make whole system more energy efficient so they have implemented the ART1 neural network on EESR protocol. In this protocol manager nodes are selected by sensor node based on ART-1 neural network. If it is 1-hop far apart than it is easy task but if it is 2-hop or more than 2-hop distance than it is energy consuming. But still EESR-ART gives better performance as comparison to LEACH, EESR, and LEACH-ART. EESR-ART gives outstanding performance in terms of end-to-end delay (QoS based) parameter.

EESR routing protocol

Energy–Efficient Sensor Routing (EESR) [7] protocol that generally works for densely deployed sensor networks. It mainly comprise of sensor nodes, gateways, manager nodes, and base station. The gateways transferred commands which are received from a manager to the base station and that of control messages received from base station. The gateway directs command to base station then after base station orders queries to sensor nodes. Base station aggregates data from sensor nodes and transports control messages to the gateway.

The sensing coverage area of specific application is categorized into four quadrants based on 2-D (x, y) coordinated. These quadrant is recognized as (+ +), (+ -), (- -), and (- +). All quadrants

are further divided into sectors in terms of distance from the base station. Number of sectors in each quadrant is discovered with the help of minimum hops required to deliver a packet from the BS to the farthest position in the quadrant. Generally, number of sectors is same in every quadrant. From fig.1, base station is situated at the center of sensing field area. Sensor nodes transfer their data to closest manager nodes. Manager nodes are situated 1-hop from each other.
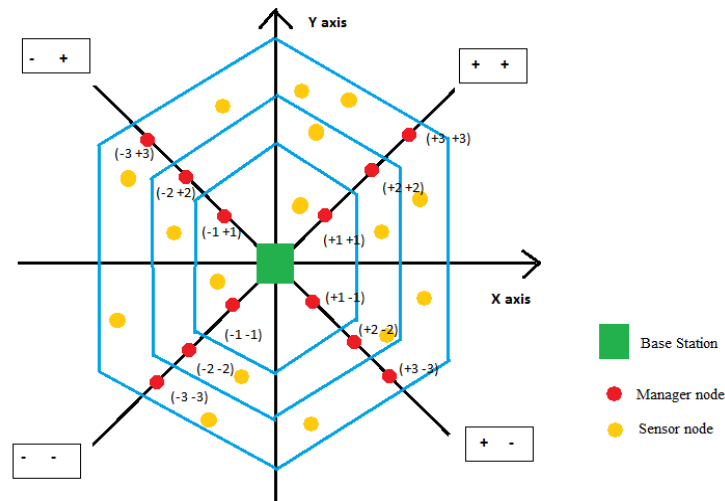
Fig1 The basic model of EESR protocol [10].

Whenever an event occurred, a sensor node explores the sector IDs of all neighboring sensor nodes which are far apart within 1-hop. If there exist a manager node within 1-hop distance, that node is nominated as the next node to deliver the event. Otherwise, if the existences of nodes are within the same sector having 1-hop distance; one of them is randomly nominated as the next node. Otherwise, one of the neighboring nodes with the smallest sector number is nominated as the next node because it is nearest to the base station. In case there is more than one node have the same smallest sector number than nodes exists in common quadrant are preferred to prevent the event from going far to the other region. After the event node selects one of the neighbors within 1- hop distance, it transfers the event only to the nominated sensor node. The nominated node, then, drives the same nomination procedure among neighboring nodes within 1-hop distance, and transfers the event only to the nominated neighbor again. This whole procedure is repeated until the event reaches at the base station. Once a manager node is nominated as the next node, the event can be transferred to the base station directly via manger-to-manager transmission.

Problem statement

In this scenario, we have concentrated over the network life time parameter i.e. overall lifetime of the sensor network must be enhanced. This can be possible if we look into EESR protocol and analyze it and do some effective changes in it. Main problems are formulated as follows:

1. We are concentrated in selection of manager node stage in EESR protocol.

2. During the selection of manager node phase, ART2 neural network is implemented in it. In first round, manager node selection is based on minimum distance from sensor nodes, then on very next round ART2 neural network help in selection as the concentration of sensor node is more in the particular quadrant than the data transmission more in that case so energy consumption is more. So, selection of manager node is according to remaining energy of manager nodes.

3. Selection of manager node by the sensor node of other quadrant where sensor node concentration is less. That will compensate the overall network energy. But if the concentration is almost similar than it will select that manager node whose remaining energy is more.

4. If the nearest sensor node has more remaining energy as comparison to manager node than that sensor node temporarily act as manager node as it is selected by ART2 network. The election of sensor node as manager node (act as router for others to transfer data to base station) leads to enhance the network lifetime of the network in EESR-ART2 algorithm is based on ART2 neural network technique.

ART-2 architecture

ART2 neural network is intuitively extension to ART1 neural network. ART2 [9] deals with analog vector components as well as binary components in contrast to ART1 only take binary component as input pattern.ART2 algorithm has basically two subsystems: attentional subsystem and an orientating subsystem. The attentional subsystem is significantly consists of two layers of processing elements, F1 and F2 and a gain control system. The ART2 architecture is as follows:
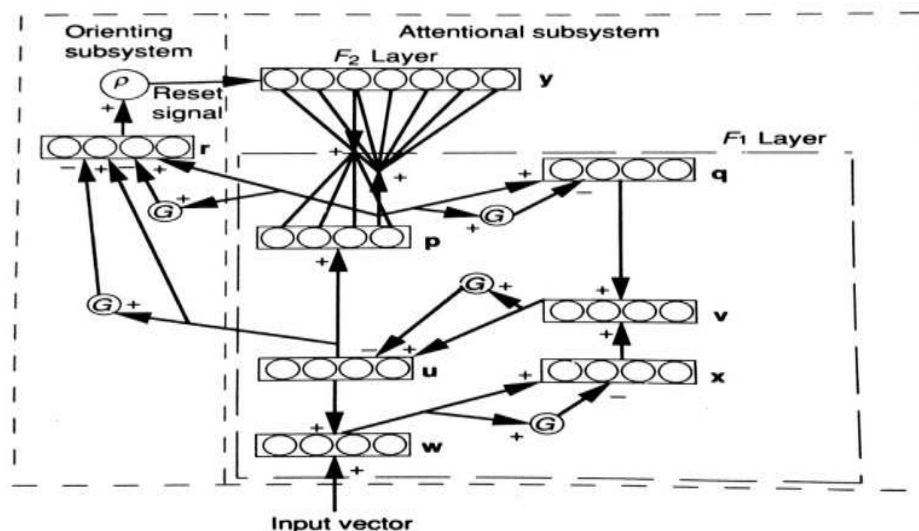
Fig2 Architecture of ART2 neural network [9].

Processing of F_1

The activity of each unit on each sublayer of F_1 is governed by an equation of the form

$$\varepsilon x_k = -Ax_k + (1-Bx_k)J_k^+ - (C+Dx_k)J_k^- \qquad \text{Eq. (1)}$$

Where A, B, C, D are constants. B and C are identically equal to zero. J_k^+ and J_k^- represent net excitatory and inhibitory factors respectively. So, specific interest in only asymptotic solution:

$$x_k = \frac{J_k^+}{A+DJ_k^-} \qquad \text{Eq. (2)}$$

Table. 1   According to Eq(2) for each F1 sublayer and r layer.

Layer	A	D	J_i^+	J_i^-
			Quantity	
w	1	1	$I_i + au_i$	0
x	e	1	w_i	$\|w\|$
u	e	1	V_i	$\|v\|$
v	1	1	$f(x_i) + b\,f(q_i)$	0
p	1	1	$u_i + \sum_j g(y_j)z_{ij}$	0
q	e	1	p_i	$\|p\|$
r	e	1	$u_i + cp_i$	$\|u\| + \|cp\|$

ART2 Processing Summary
Here, steps required for processing that includes equations and constraints.
M: number of units in each F_1 sublayer.
N: number of units on F_2
Parameters are chosen according to the following constraints:
$a, b > 0$
$0 \le d \le 1$
$\frac{cd}{1-d} \le 1$
$0 \le \theta \le 1$
$0 \le \rho \le 1$
$e \ll 1$
Top-down weights are all initialized to zero:

$z_{ji}(0) = 0$

Bottom-up weights are initialized according to

$$z_{ji}(0) \leq \frac{1}{1-d\sqrt{M}}$$

Now steps to process data.

1. Initialize all layer and sub-layer outputs to zero vectors, and establish a cycle counter initialized to a value of one.

2. Apply the input pattern, **I** to the **w** layer of F_1. The output of this layer is

$w_i = I_i + au_i$

3. Propagate forward to the x sublayer

$$x_i = \frac{w_i}{e+||\boldsymbol{w}||}$$

4. Propagate forward to the **v** sub-layer

$V_i = f(x_i) + b\,f(q_i)$

Note that the second term is zero on the first pass through, as **q** is zero at that time.

5. Propagate to the **u** sublayer.

$$u_i = \frac{V_i}{e+||\boldsymbol{v}||}$$

6. Propagate to the **p** sublayer.

$p_i = u_i + dz_{iJ}$

> Where the Jth node on F2 is the winner of the competition on that layer.

> If F_2 is inactive, $p_i = u_j$. Similarly, if the network is still in its initial configuration,

> $p_i = u_i$ because $z_{ij}(0) = 0$.

7. Propagate to the **q** sublayer

$$q_i = \frac{p_i}{e+||\boldsymbol{p}||}$$

8. Repeat steps 2 through 7 as necessary to stabilize the values on F_1.

9. Calculate the output of the **r** layer.

$$r_i = \frac{u_i + cp_i}{e+||\boldsymbol{u}||+||c\boldsymbol{p}||}$$

10. Determine whether a reset condition is indicated. If $p/(e + ||r||) > 1$, then send a reset signal to F_2. Mark any active F_2 node as ineligible for competition, reset the cycle counter to one, and return to step 2. If there is no reset, and the cycle counter is one, increment the cycle counter and continue with step 11. If there is no reset, and the cycle counter is greater than one, then skip to step 14, as resonance has been established.

---

11.   Propagate the output of the **p** sublayer to the F_2 layer. Calculate the net inputs to F_2

$$T_j = \sum_{i=0}^{M} p_i \, z_{ji}$$

12.   Only the winning F_2 node has nonzero output.

$$g(T_j) = \begin{cases} d & T_j = \max_k\{T_k\} \\ 0 & otherwise \end{cases}$$

Any nodes marked as ineligible by previous reset signals do not participate in the competition.

13.   Repeat steps 6 through 10.
14.   Modify bottom-up weights on the winning F_2 unit.

$$z_{Ji} = \frac{u_i}{1+d}$$

15.   Modify top-down weights coming from the winning F_2 unit.

$$z_{iJ} = \frac{u_i}{1-d}$$

16.   Remove the input vector. Restore all inactive F_2 units. Return to step 1 with a new input pattern.

Experimental Results

The simulation is implemented in MATLAB (2009b) for the proposed algorithm EESR-ART2. There are five routing protocol has been taken for comparative analysis i.e LEACH, LEACH-ART1, LEACH-ART2, EESR-ART1, EESR-ART2. Table 2 shows general parameters of EESR-ART2 algorithm. Table 3 shows the initial energy parameters for each sensor nodes. Our simulation results give network lifetime graph as shown in Fig.3. The overall network lifetime is enhanced at greater extent of the proposed algorithm i.e. EESR-ART2.

Table. 2   General parameters of EAS-ART algorithm

S. No.	General Parameters	
1.	Field Dimensions	100m x 100m
2.	Number of nodes	100

Table. 3   Initial energy parameters

S. No.	Energy Parameters	
1.	Battery energy	0.5 Joules
2.	Energy model parameter: ε_{fs}	$1 *10^{-11}$
3.	Energy model parameter: ε_{mp}	$1.3 * 10^{-15}$
4.	Electronics Energy: E_{Elec}	50 nJ/bit

5.	Data packet length	4000 bits
6.	Control packet length	200 bits
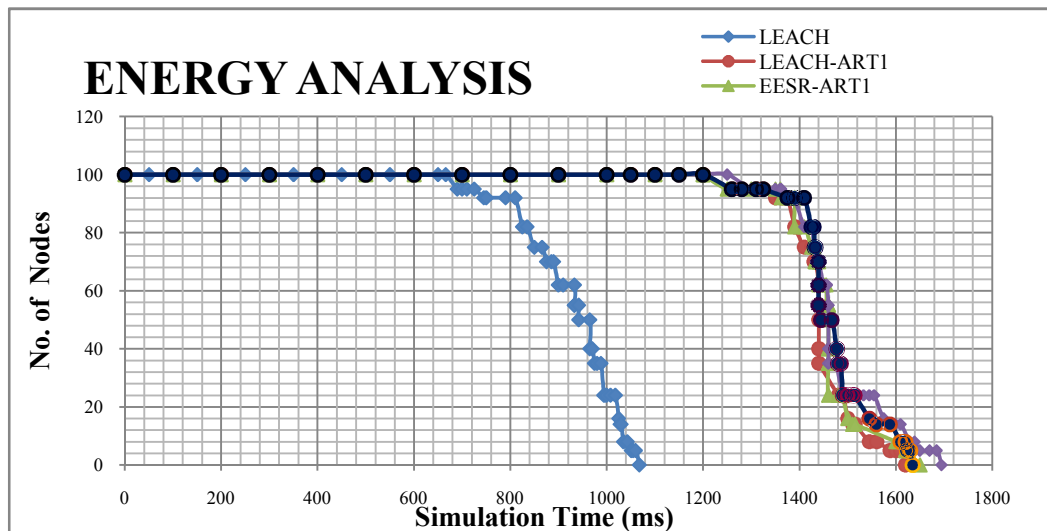
Fig. 3   Energy analysis of LEACH, LEACH-ART1, LEACH-ART2, EESR and EESR-ART2 algorithms

Conclusion

The energy efficient system is one of the major requirements in wireless sensor network of today's date. To get this performance we need to overcome major constraints like limitation of power, packet delivery delay, latency etc. In this paper, proposed algorithm i.e. EESR-ART2 performance better than other algorithms i.e. LEACH, LEACH-ART1, LEACH-ART2, EESR-ART1 as shown in fig 3. Our aim was to enhance the energy lifetime of wireless sensor network and our simulation results of proposed algorithm has shown good impact over the power saving of the network.

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Comparative flexural strength of concrete by partial replacement of sand with basic oxygen furnace slag

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Abstract: This research work evaluates the use of basic oxygen furnace slag as a replacement for fine aggregates, in M-25 grade of concrete. The fine aggregates were partially replaced, by weight with Basic oxygen furnace slag. The prepared mixes were named as Mix-A, Mix-B, Mix-C and Mix-D. The mixes were prepared at 0%, 15%, 25% and 35% replacement levels respectively. All the mixes were fabricated at 0.46 water cement ratio. To study the behavior and response of beam members, casted with above said composition, in flexure, the tests performed after 7 and 28 days on beam specimens casted from control and composite mixes, were flexural strength test, density and slump test. IS standards were followed while conducting the above captioned tests. The obtained results were compared with those of controlled M-25 concrete mix.

The investigated results found, vary according to proportions of supplementary constituents added to the M-25 concrete mix. The substitution of basic oxygen furnace slag, enhances the Flexural strength of M-25 concrete mix up to certain percentage. After adding 15% basic oxygen furnace slag in the mix, there is an increase of 17.67% strength after 7 days, and 17.26% increase after 28 days. The flexural strength increase as compared to control mix as the percentage of basic oxygen furnace slag is increased. At 25% addition of basic oxygen furnace slag in the mix, there is an increase of 28.37% strength after 7 days, and 23.31% increase after 28 days. A decline in flexural strength as compared to control mix was observed when the percentage of basic oxygen furnace slag was increased to 35%. A decrease by 3.16% was observed after 7 days, and 16.42% decrease after 28 days. Slump and unit weight of thus manufactured concrete also increases with the addition of Basic oxygen furnace slag to it. Thus basic oxygen furnace slag can be successfully used in concrete, to improve flexural strength, slump values and unit weight of concrete as well.

Key words: *Basic oxygen furnace slag, concrete, fine aggregate, flexure, Portland cement.*

Introduction

Production of residues from industries and construction sector has increased during last few years. Much of these wastes have been thrown to land fill, without considering their potential for reuse and re-cycling as well. Since aggregates make about 70-80 volume of the concrete, their

influence on various properties of concrete is considerable. Throughout India, we have been using natural sand and gravel in the fabrication of concrete. Since there is scarcity of sand and natural coarse aggregates all over India, their availability is becoming costly day by day and their extraction poses a threat to environment, ground water table and many more natural resources. For instance the sand bed was acting as a filter media for subsurface water, its extraction will deplete the subsurface water and render it unfit for use.Hence this is dire need of the hour to promote use of wastes and by products in civil engineering constructions. This research work evaluates the effect of partial replacement of sand with basic oxygen furnace slag on the properties of concrete like flexural strength, slump and unit weight.

Basic oxygen furnace slag is formed during the conversion of hot metal from the blast furnace into steel in a basic oxygen furnace. In this process the hot metal is treated by blowing oxygen to remove carbon and other elements that have a high affinity to oxygen. The slag is generated by the addition of fluxes, such as lime stone or dolomite that combines with silicates and oxides to form liquid slag. Some amounts of scrap are also added in order to control the temperature of the exothermal reactions. When the reaction process is complete, molten crude steel collects on the bottom of the furnace and the liquid slag floats on top of it as shown in figure 1.1[2].
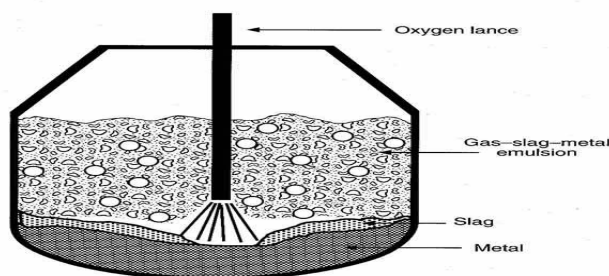
| Figure 1.1: Basic oxygen Furnace | Figure 1.2: Basic oxygen furnace slag |

Energy dispersive x-ray spectroscopy

EDS analysis is a qualitative x-ray micro analytical technique that provides information about the elemental composition of a material and is useful in identifying metals. Figure 1.3 and 1.4 shows graphically the electronic composition of basic oxygen furnace slag and the electron image respectively. The EDS test on basic oxygen furnace slag sample was conducted in Sai lab Thapar university Patila Punjab.

The elemental composition of basic oxygen furnace sample from EDS analysis is shown in table1.1
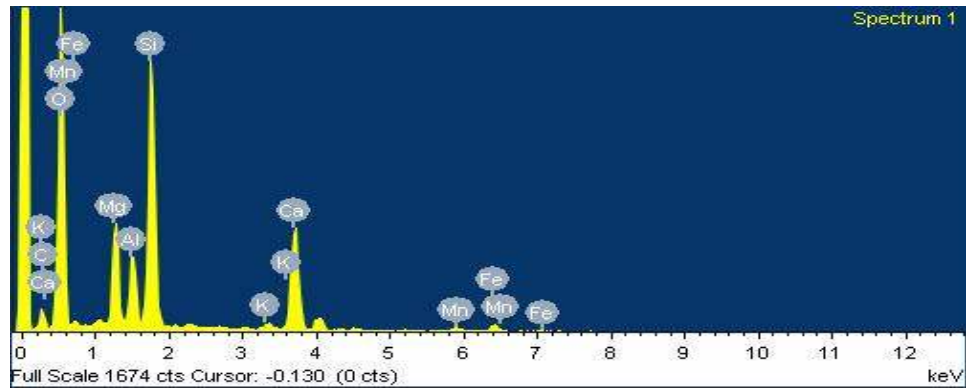
Figure 1.3: EDS graph of basic oxygen furnace slag

Figure 1.4: Electron Image of basic oxygen furnace slag

Element	Weight%	Atomic%
C	8.85	15.87
O	44.29	59.63
Mg	0.44	0.39
Al	8.57	6.84
Si	6.15	4.72
Ca	0.79	0.42
Ti	0.64	0.29
Cr	4.24	1.76
Mn	6.10	2.39
Fe	19.92	7.68

Table 1.1: Elemental composition of basic oxygen furnace slag

Literature review

Germans were using cannon balls manufactured from iron slag from early 1589 and records are still available that cast iron slag were used in masonry work in Europe from 18th century .Some 2000 years ago Romans used broken slag obtained from crude iron making forges in road building. Slag was first used in England as a construction material in the construction of roads and blocks cast from slag were used in paving of streets in Europe and US. For instance Iranian blast furnace and steel production units generate 1 and 1.3 million tons of slag per year respectively. Numerous experimental research actions done for the utilization of this volume of slag are as under [18].

Avinash in 2014 analyzed the effect of blast furnace and basic oxygen furnace slag on the properties of concrete. In this study, blast furnace and basic oxygen furnace slag is physically characterized and separately replaced with natural river fine aggregate and normal weight coarse aggregate. This comparative study indicated that concrete produced by using basic oxygen furnace slag has yielded the greater compressive strength when compared to concrete produced by using blast furnace slag and natural river sand [2].

Chetan khajuria in 2014 investigated that the strength characteristics of concrete mixtures had been computed in the present work by replacing 10%, 20% and 30% iron slag with the sand. On the basis of testing, subsequent conclusions were drawn. After adding 10% iron slag in the mix, there was an increase of 26% after 7 days, 50% increase after 28 days and 43% increase after 56 days as compared to the control mix. By adding 20% and 30% iron slag, there was large amount of increase in percentage i.e. 68%, 91%, 78% and 125%, 113%, 87% after 7, 28 and 56 days respectively[3].

Methodology

- Collection of all information and studies related to the basic oxygen furnace slag.
- Bringing samples of basic oxygen furnace slag from the sites of production.
- Clean and dry the samples.
- Making sieve analysis of the basic oxygen furnace slag and natural aggregates.
- Determination of fineness modulus of all material like sand, coarse aggregates, basic oxygen furnace slag.
- Prepare the concrete mixes with appropriate percentages by weight of natural aggregate and basic oxygen furnace slag separately.
- Prepare the controlled M-25 concrete design mix and three more mixes of concrete one (Mix-B) at 15% replacement by weight of sand with basic oxygen furnace slag the other two mixes (Mix-C) and (Mix-D) at 25% and 35% replacements levels respectively.

The following tests were conducted to achieve the research objectives

- Fineness test for cement.
- Soundness test of cement.
- Slump test.
- Determination of density of different concrete mixes prepared (15x15x15cm cubes).
- Sieve analysis for basic oxygen furnace slag and Natural aggregates.
- Water absorption test for natural aggregates.
- Flexural strength test of beam specimens of size 150mm x 150mm x 700mm, after 7 and 28 days.
- Result discussion and conclusion of the test results and recommendation for future tests.

```
┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐
│ Six specimens   │ ──> │ Three specimens │ ──> │ Three specimens │
│ from each mix.  │     │ from each mix   │     │ from each mix   │
│                 │     │ tested after 7  │     │ tested after    │
│                 │     │ days.           │     │ 28days.         │
└─────────────────┘     └─────────────────┘     └─────────────────┘
                                │                         │
                                v                         v
                        ┌──────────────┐          ┌──────────────┐
                        │ Average      │          │ Average      │
                        │ Value        │          │ value        │
                        └──────────────┘          └──────────────┘
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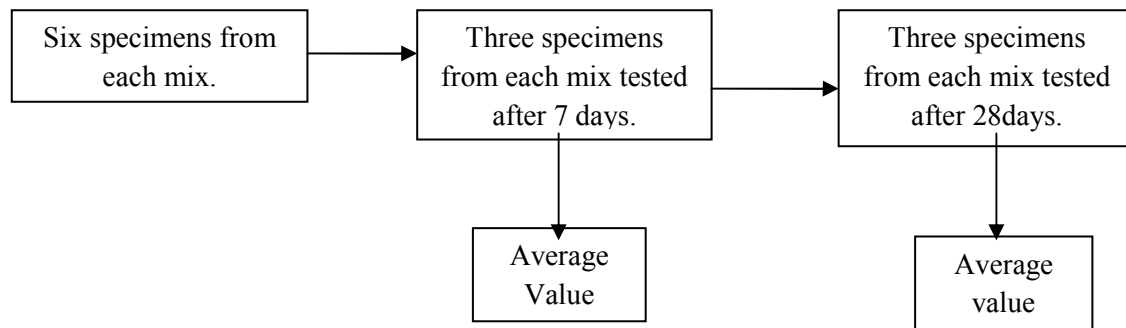
Figure 2.1: Test result evaluation chart

Figure 2.2: Samples

Materials used

The selection of aggregate material is important as aggregates control concrete properties and make up 60% - 75% of the total concrete volume. Hence careful attention should be given in the selection and proportioning of aggregates.

Materials

The materials used in the test program were ordinary portland cement, natural coarse aggregate, basic oxygen furnace slag, Sand and Water. The material properties are as under

Cement

Ordinary Portland cement of 43 grade was used throughout the investigation. The cement was available in the local market Ambala city and kept in dry location. The tests were conducted to determine the properties of cement following IS:8112-1989 standards. The test results are shown in table 3.1[11].

Water

Tap water, potable without any salts or chemicals was used in the study. The water source was the concrete laboratory in Ram devi jindal college[14].

Natural aggregates

In this study, both coarse and fine aggregates were used to prepare a controlled as well as basic oxygen furnace slag added concrete. The various physical properties of coarse aggregates and fine aggregates were investigated using IS:383-1970 standards[8].

S.No	Property	Results
1	Fineness	3%
2	Soundness	1 mm
3	Setting time	Initial = 95 minutes Final = 165 minutes
4	Specific gravity	3.15
5	Compressive strength	After 7 days = 33.2 MPa
		After 28 days = 44.32 MPa

Table 3.1: Physical properties of Ordinary Portland Cement (IS: 8112-1989)

Sieve analysis of all the types of aggregates was done as per IS specifications following IS:383-1970 standards. For coarse aggregates a sample weighing 3kg, a sample weighing 1kg from fine aggregates and 1kg from basic oxygen, were taken for sieve analysis of all the three materials. The percentage of material retained on different sieves and fineness modulus for for the above said materials are shown in table 3.2, table3.4 and table 3.6 respectively[5].

Sieve size	Material retained (gm)	Percentage retained	Cumulative %age passing	Cumulative %age retained
80 mm	0	0.00	100	0.00
40 mm	0	0.00	100	0.00
20 mm	68.5	2.28	97.72	2.28
10 mm	2776.5	92.55	5.17	94.83
4.75 mm	113.5	3.78	1.38	98.62
2.36 mm	0	0.00	0.00	100
1.18 mm	0	0.00	0.00	100
600 μ	0	0.00	0.00	100
300 μ	0	0.00	0.00	100
150 μ	0	0.00	0.00	100
Pan	0	0.00	-	-
Sum	3000		Sum	695.73
FM				6.95

Table 3.2: Sieve Analysis of Natural Coarse Aggregate with Max. Size of 20mm 3kg sample (IS: 383-1970)

The physical properties of coarse and fine aggregates are listed in table 3.3 and table 3.5 respectively [9].

Characteristics	Value
Colour	Grey
Shape	Angular
Maximum size	20mm
Specific Gravity	2.64
Total water absorption	1.01%
Fineness Modulus	6.96

Table 3.3: Physical properties of natural coarse aggregates following IS: 2386-3-1963 standards

Sieve Size	Material retained (in gm)	Retained %age	Cumulative %age passing	Cumulative %age retained
4.75 mm	14.5	1.45	98.55	1.45
2.36 mm	37	3.70	94.85	5.15
1.18 mm	246.5	24.65	70.20	29.80
600 μ	205.5	20.55	49.65	50.35
300 μ	287.5	28.75	20.90	79.10
150 μ	177	17.70	3.20	96.80
Pan	32	3.20	-	-
Sum	1000		Sum	262.65
FM				2.62

Table 3.4: Sieve analysis of Natural Fine Aggregates (1kg) as per IS: 383-1970

Characteristics	Value
Water absorption	2.04
Fineness modulus	2.63
Bulk density	2.60
Specific Gravity	2.57

Table 3.5: Physical properties of natural fine aggregate IS: 2386-3-1963

Basic oxygen furnace slag

The basic oxygen furnace slag and was collected from Bassi steel ltd and JTL Infrastructure ltd. same procedure and IS

specifications were followed in sieve analysis as for fine and coarse aggregates [5].

Mix proportions

Concrete design mix

The design control mix and mixes with varying proportions of basic oxygen furnace slag were manufacture as per IS: 10262-2009 and IS:456-2000 specifications [6]. All types of aggregates were weigh batched and the weights of all the material as per IS design of M-25 grade of concrete are listed in table 4.1[14].

Sieve Size	Material retained in gms	Retained %age	Cumulative %age passing	Cumulative %age retained
4.75 mm	22	2.2	97.8	2.2
2.36 mm	51	5.1	92.7	7.3
1.18 mm	165	16.5	76.2	23.80
600 μ	247	24.7	51.5	48.50
300 μ	279	27.9	23.6	76.40
150 μ	137	13.7	9.9	90.10
Pan	93	9.3	-	-
Sum	1000	-	Sum	248.3
FM				2.48

Table 3.6: Sieve analysis of basic oxygen furnace slag (1kg sample) as per IS: 383-1970

Characteristics	Value
Water absorption	0.40
Fineness modulus	2.48
Specific Gravity	2.69

Table 3.7: Physical properties of basic oxygen furnace slag following IS: 2386-3-1963

Material Description	Material source	Mix-A Kg/m^3	Mix-B Kg/m^3	Mix-C Kg/m^3	Mix-D Kg/m^3
Cement (OPC) 43 Grade	Ambala City	418	418	418	418
Natural Fine sand	Pathankot sand (Zone II)	660	561	495	429

Natural coarse Aggregate	Handesra stone crusher	1105	1105	1105	1105
Basic Oxygen furnace slag	Derabassi, Bassi steel	Nil	99	165	231
Water cement ratio	-	0.46	0.46	0.46	0.46
Free Water	RDJ lab water	192	192	192	192
Ratios (Cement:Sand:BOF-Slag:Coarse aggregate)	-	1:1.27:0:2.64	1:1.34:0.21:2.64	1:1.18:0.39:2.64	1:1.02:0.55:2.64

Table 4.1: Mix-proportions of different mixes as per IS: 10262-2009 and IS: 456-2000 standards.

Figure 4.1: Concrete mix with basic oxygen furnace slag

The dry mixture of one of the fabricated mixes as per proportions in table 4.1 is shown in figure 4.1

Results

Slump

The slump increases with the increase in the percentage of basic oxygen furnace slag in the concrete & reaches a maximum of 72mm at 35% replacement of sand with basic oxygen furnace slag, when compared with control mix of concrete[16][14].

Mix	Percentage replacement of fine Aggregate	Slump(mm)
Mix-A	0%	58
Mix-B	15%	63
Mix-C	25%	68
Mix-D	35%	72

Table 5.1: Slump values obtained

Figure 5.1: Slump test

Density of mixes

The average weight of Test specimens cubical in shape shall be15 X 15 X 15 cm, conforming to IS:10086-1982, casted from control mix (Mix-A) concrete is 7.84kg. As the percentage of basic oxygen furnace slag increases subsequently the average weight of all the fabricated mixes increase and reaches a maximum of 8.858 Kg in Mix-D [17].

Mix	Age of cubes (days)	%age Replacement of fine Aggregate	Average Weight (Kg)	Volume of Cubes (m³)	Mass Density of Concrete (Kg/m³)
Mix-A	28	0%	7.84	0.003375	2323
Mix-B	28	15%	8.21	0.003375	2432.6
Mix-C	28	25%	8.428	0.003375	2497.2
Mix-D	28	35%	8.858	0.003375	2624.59

Table 5.2: Densities of various mix proportions

Flexural strength test

- **Apparatus**

The testing machine may be of any reliable type of sufficient capacity for the tests. The permissible errors shall be not greater than ± 0·5 percent of the applied load where a high degree of accuracy is required and not greater than ± 1·5 percent of the applied load for commercial type of use. The bed of the testing machine shall be provided with two steel rollers, 38 mm in diameter, on which the specimen is to be supported, and these rollers shall be so mounted that the distance from centre to centre is 60 cm for 15cm specimens The load shall be applied through two similar roller", mounted at the third points of the supporting span, that is, spaced at 20 or 13·3 cm centre to centre. The load shall be divided equally between the two loading rollers, and all rollers shall be mounted in such a manner that the load is applied axially and without subjecting the specimen to any torsional stresses or restraints. One suitable arrangement which complies with these requirements is indicated in Figure 5.2.

- **Procedure**

Test specimens stored in water at a temperature of 24^0C to 30°C for 48 hours before testing, shall be tested immediately on removal from the water whilst they are still In a wet condition. The dimensions of each specimen shall be noted before testing. No preparation of the surfaces is required.

- **Placing of testing specimen in testing machine**

The bearing surfaces of the supporting and loading rollers shall be wiped clean, and any loose sand or other material removed from the surfaces of the specimen where they are to make contact with the rollers. The specimen shall then be placed in the machine in such a manner that the load, shall be applied to the uppermost surface as cast in the mould, along two lines spaced 20·0 or 13·3 cm apart. The axis of the specimen shall be carefully aligned with the axis of the loading device. No packing shall be used between the bearing surfaces of the specimen and the rollers, The load shall be applied without shock and increasing continuously at a rate such that the extreme fibre stress increases at approximately 7 kg/sq cm/min. that is, at a rate of loading of 400 kg/min for the 15cm specimen.

The load shall be increased until the specimen fails, and the maximum load applied to the specimen during the test shall be recorded. The appearance of the fractured faces of concrete and any unusual features in the type of failure shall be noted [17].

Calculation

The flexural strength of the specimen shall be expressed as the modulus of rupture fb, which if "a" equals the distance between the line of fracture and the nearer support measured on the centre line of the tensile side of the specimen in cm, shall be calculated to the nearest 0-5 kg/sq.cm as follows:

$fb = p{\times}l/bd^2$

When "a" is greater than 20cm for 15cm specimen.

or

$fb = 3p{\times}a/bd^2$

When "a" is less than 20cm but greater than 17cm for 15cm specimen.

b = measured width in cm of the specimen.

d = measured depth in cm of the specimen at the point of failure.

l = length in cm of the span on which the specimen was supported, and

p = maximum load in kg applied to the specimen

If "a" is less than 17cm for a 15cm specimen, the results of the test shall be discarded.

This test was performed on the Beam samples (15 x I5 x 70 cm) conforming to IS: 10086-1982 and following IS: 516-1959 standards, at the age of 7 and 28 days. The 7 days and 28 days results are presented in table 5.3[7].

Figure 5.2: Flexural strength testing machine with beam specimen (IS: 516-1959).

The specimens casted for flexural strength test are shown in figure 5.3[17] The average flexural strength of basic oxygen furnace slag concrete at the different age of 7days and 28days is show in Table 4.3[7].

Figure5.3: Flexural strength Standard beam specimens (15 x I5 x 70 cm) conforming to IS: 10086-1982

Mix	Flexural strength (Kg/cm^2)		Average flexural strength (Kg/cm^2)	
	7Days	28Days	7Days	28Days
A	58.30	70.23	54.94	65.57
	56.37	65.54		
	50.15	60.96		
B	64.42	77.78	64.65	76.89
	68.60	76.25		
	60.95	76.66		
C	70.13	80.42	70.53	80.86
	70.54	80.83		
	70.94	81.34		
D	54.23	57.28	53.20	54.80
	54.12	56.27		
	51.27	50.86		

Table 5.3: Flexural strength test results for the beam samples (15 x 15 x 70 cm) confirming to IS: 516-1959 methods of tests for strength of concrete.

Flexural strength in percentage after adding basic oxygen furnace slag

The Flexural strength decrease as compared to control mix (Mix-A) as the percentage of basic oxygen furnace slag is increased to 35% in the mix, a decrease in flexural strength by 3.16% was observed after 7 days, and 16.42% decrease after 28 days[7].

Test results and discussion

- **Workability**

The workability of M-25grade of concrete improved upto 35% replacement level by 24.14% than that of M-25 control mix (Mix-A).The workability improved due to potential availability of finer materials.

- **Density**

The density of all the mixes fabricated at different replacement levels of sand with basic oxygen furnace slag increase and attains a maximum at 35% replacement level, by a margin of 12.98% than that of Mix-A, prepared at 0% replacement of sand. The continuous increase in density of mixes is due to greater unit weight of basic oxygen furnace of slag. Thus the concrete mixes fabricated by utilizing basic oxygen furnace of slag can be suggested for use in constructions, where heavy mass concreting is done to achieve stability by virtue self weight. For example hydraulic gravity dams, foundations etc.

- **Flexural Strength**

Results of flexural strength test on concrete with varying proportions of basic oxygen furnace slag replacement at the age of seven and 28 days are given in table. The flexural strength continuously increase upto 25% replacement of sand with basic oxygen furnace slag and decreases when the percentage of replacement is increased to 35%.We conclude that the flexural strength at 35% replacement level of sand with basic oxygen furnace slag is less than that of 0% replacement of sand[16].

Conclusions

Following are the conclusions draw from the above research work.

- From the slump test results, the concrete produced with basic oxygen furnace slag gives higher values of slump i.e., 72 mm at 35% replacement level than controlled M-25 grade concrete, prepared with 0% replacement of sand.
- From the obtained values of density, basic oxygen furnace slag based concrete gives higher value of density than controlled M-25 grade of concrete and a maximum value of 2497.2 Kg/m^3 is achieved at 35% replacement. Thus can be recommended for use in

structures like hydraulic gravity dams, foundations etc., where heavy mass concreting is done to achieve stability by virtue of self weight of structure.

- At 15% & 25% replacement by weight of fine aggregate with basic oxygen furnace slag, a remarkable achievement in flexural strength was observed.

- When the percentage of replacement, is increased to 35%, the flexural strength decreases abruptly.

- The 7 days flexural strength increased by 17.67%, 28.37%, in case of basic oxygen furnace slag based concrete at 15%, 25% replacement levels respectively & decreases by 3.16% & 6.18% at 35% replacement level.

- The 28 days flexural strength increased by 17.26%, 23.31% in case of basic oxygen furnace slag based concrete at 15%, 25% replacement levels respectively and decreases by 16.42% & 20.13% at 35% replacement level.

- Hence it could be recommended that basic oxygen furnace slag could be effectively utilized as fine aggregates in all concrete applications, upto certain replacement levels of fine aggregate as discussed in the results to improve the strength of concrete in Flexure.

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Performance Analysis of JIT and Non-JIT Industries on the Basis of T-Test

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Abstract: JIT or Just in Time is a manufacturing model where the products are manufactured to meet the needs and not produced in surplus or in advance of need. This is an inventory strategy companies employ to increase efficiency and decrease waste by receiving goods only as they are needed in the production process, thereby reducing inventory costs. This method requires producers to forecast demand accurately. In order to identify critical elements of JIT and to compare the performance analysis of JIT and non-JIT based industries, this paper describes detailed survey of different manufacturing industries like automobile industry, its ancillaries, steel and electronic component manufacturing industry. The data contained in this paper is received from 20 different industries, which was statistically analysed on the basis of T-Test analysis technique.

Using T-test analysis performance parameters such as effectiveness of production planning (3.076), accuracy of demand forecasting (2.966), accuracy of completing production plan (3.112), level of inventory control (2.92), zero deviation schedule (3.289) has shown immense improvement in terms of JIT and non-JIT based industries. The non-JIT based industries were poor in performance in terms of continuous improvement (0.104), level of WIP reduction (0.120), level of inventory control (0.516), and operation cost (0.307). In this study attempts are made to lower down cost of production and to keep production flow and inventory in control. In broad sense it can be said that study is performed by procuring material at the time and place it is required. The process control is done in the same sense i.e. process is carried out at every stage only if it is demanded for the proceeding stage.

Keywords: *Kaizen, Kanban, Zero Inventory, Stock Procurement, Waste Elimination*

Introduction

JIT or Just in Time is a manufacturing model where the products are manufactured to meet the needs and not produced in surplus or in advance of need. This is an inventory strategy companies employ to increase efficiency and decrease waste by receiving goods only as they are needed in the production process, thereby reducing inventory costs. This method requires producers to forecast demand accurately. This is a technique in which attempts are made to lower down cost of production and to keep production flow and inventory in control. In broad sense it can be said

that attempts are made to procure material at the time and place it is required. The process control is done in the same sense i.e. process is carried out at every stage only if it is demanded for the proceeding stage. At first of all TOYOTA adopted this technique to eliminate seven wastes. Alternative terms for JIT manufacturing have been used. It was named short-cycle manufacturing (SCM) by Motorola and IBM coined it as demand-flow manufacturing (DFM) and continuous-flow manufacturing (CFM).

Despite appreciable industrialization in India, mere amount of research has been carried out to improve the quality at optimum cost. Traditional manufacturing systems like job shop, and continuous flow production systems are still prevalent in Indian industries. The JIT system in long run offers an efficient potential in tremendous savings in labour, overhead, material and waste reduction, thereby reducing the cost of end product.

This study is based on 20 industries based on JIT and JIT manufacturing techniques based in Jammu & Kashmir, Punjab and Haryana.

Methodology

The mean of two groups statistically different from each other can be assessed by a T-Test. The analysis is appropriate when comparing the means of two groups. A T-Test is any statistical hypothesis test in which the test statistics follows a T-distribution if the null hypothesis is true. If the value of a scaling term in the statistic were known the test statics would follow a normal distribution, T-Test is hence most commonly applied. When the term is unknown and is replaced by an estimate based on the data, the test statistics (under certain conditions) follows a T-distribution.

The evaluation of T-Test provides ratio which is just the difference between the two means or averages. The ratio is a measure of the variability or depression of the scores. It is concluded that the T-Test ratio is a measure of variability to see the group difference. The formula for the test is given as:

$$T = \frac{\bar{x} - \mu}{s} \times \sqrt{n}$$

$$\text{where} \quad S = \frac{\sqrt{\sum (x - \bar{x})^2}}{n - 1}$$

$\bar{x}$ = Mean of Slope μ = Hypothetical mean of the population

n = The sample size   S = The standard deviation of the sample

Result

Various production performance variables are analyzed on the basis of T-Test, which are given in the table 1.1

Production Performance Variable	T-value	Description of variable
PP01	3.076	Effectiveness of production planning
PP02	2.966	Accuracy of demand forecast
PP03	0.899	Level of WIP reduction
PP04	0.210	Degree of on-time delivery
PP05	1.698	Degree of quality
PP06	1.958	Setup time reduction
PP07	0.132	Continuous improvement
PP08	0.231	Process flexibility
PP09	1.689	Zero defects
PP10	3.289	Zero deviation schedule
PP11	3.112	Accuracy of completing production plan
PP12	1.80	Flexibility of production planning
PP13	1.69	Reduced manufacturing lead time
PP14	2.92	Level of inventory control
PP15	0.205	Operation cost

Table 1.1 T-values for different production variables for JIT industries

From table 1.1, it can be observed that performance variables such as effectiveness of production planning, accuracy of demand forecasting, accuracy of demand forecasting, degree of quality, setup time reduction, accuracy of completing production plan, flexibility of production planning, and level of accuracy control have positive impact on the performance of JIT based industries because of high T-values. Whereas the variables such as operation cost, process flexibility and continuous improvement have low impact on the performance of JIT based industries because of low T-values.

Figure 1.1 shows the plot of T-values for different variables and clearly depicts the production variables having high and low impact on production performance of JIT industries.
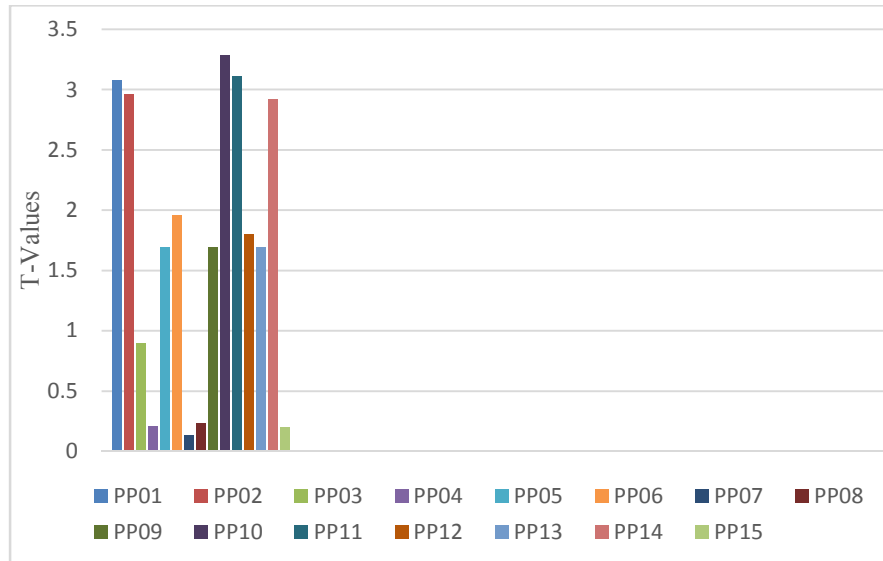
Figure 1.1 Production variables versus T-value for JIT industries

Similarly, T-Test was carried out for non-JIT industries and the T-values obtained are given in table 1.2.

Production Performance Variable	T-value	Description of variable
PP01	1.073	Effectiveness of production planning
PP02	1.570	Accuracy of demand forecast
PP03	0.120	Level of WIP reduction
PP04	1.019	Degree of on-time delivery
PP05	0.996	Degree of quality
PP06	0.699	Setup time reduction
PP07	0.104	Continuous improvement
PP08	1.129	Process flexibility
PP09	0.721	Zero defects
PP10	1.071	Zero deviation schedule
PP11	1.128	Accuracy of completing production plan
PP12	0.631	Flexibility of production planning
PP13	0.728	Reduced manufacturing lead time
PP14	0.516	Level of inventory control
PP15	0.307	Operation cost

Table 1.2 T-values for different production variables for non-JIT industries

From table 1.2, it can be concluded that that performance variables such as effectiveness of production planning, accuracy of demand forecasting, accuracy of demand forecasting, degree of quality, setup time reduction, accuracy of completing production plan, flexibility of production planning, and level of accuracy control have least impact on the performance of non-JIT based industries as compared to JIT based industries because of low T-values.

Figure 1.2, clearly depicts the type of production variables having high and low impact on production performance of non-JIT industries.
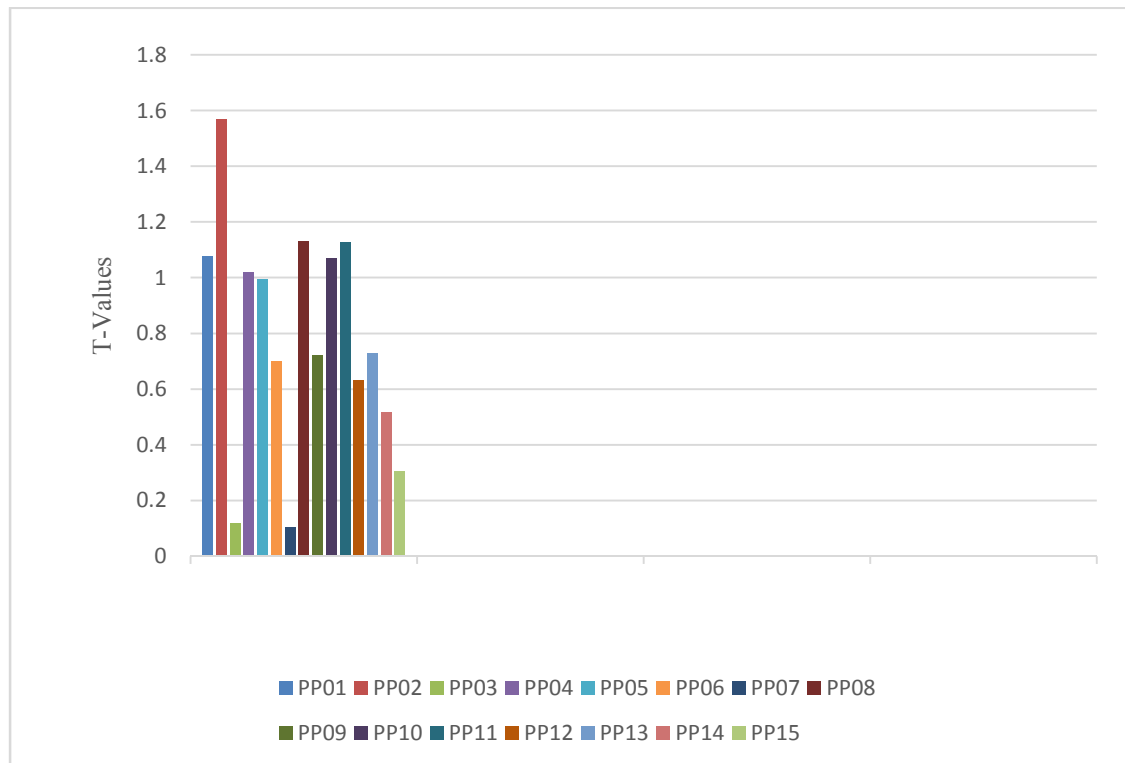

Figure 1.2 Production variables versus T-value for non-JIT industries

Conclusion

On the basis of T-Test, it can be concluded that in case of some high impact production variables such as effectiveness of production planning, zero deviation schedule, accuracy of completing production plan, accuracy of demand forecasting, the percentage variation is more than double in the case of JIT based industries when compared to non-JIT based industries.

In case of production variables such as setup time reduction, process flexibility. Reduced manufacturing lead time, zero defect, the percentage variation is nearly 100% when comparing JIT industries with non-JIT based industries.

Based on the T-Test values, non-JIT based industries show poor performance in terms of production variables such as level of WIP reduction, operation cost, and continuous improvement.

Future Scope

The study can be extended to specific type of manufacturing industries with due modifications. This study can be replicated by employing different sampling approaches, increasing the sample sizes and collecting wider ranging manufacturing firms to drive more information and higher reliability.
Some pore performance parameters can be selected for comparison.
Different types of more statistical analysis can be carried out to get more reliable conclusions.

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Patient Psychology and Hospital Design

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Abstract - This paper is an attempt to understand the need for a change in the approach towards Hospital Architecture. Further it examines methodically the intangible aspects of psychology with respect to design of Hospitals and how it can play a greater role in modern day health care design.

Key Words: *Patient, Psychology, Hospital design*

Introduction

Hospital…. the word itself evokes certain images in common man's mind, images of helplessness, of sickness, and of death. Isn't it a dilemma that Hospital, an institution connected with absolutes such as life and death, should give rise to such feelings?

Hence arises the need for a change in the approach towards Hospital Architecture. Insight into the aspects of human psychology can be the answer to produce healing environments for the ailing population. This dissertation is intended to be a beginning in this direction.

Hospital Design - The Background

The word 'patient' owes its origin to the western hospitals in the middle ages, which were primarily associated with death rather than life. Their main aim was to protect healthy from infection and to prepare sick for death. The sick were called patients because they were patiently awaiting the course of events. (1)

At that time hospitals were cruciform halls with the nuns' nursing station at the centre and an altar at the end. Gradually, the idea that hospitals were about life rather than death began to dawn. Now, other problems like hygiene were focused on.

As time passed by, many super specialties were discovered and slowly the hospital became a complex containing many things. (2)

i. Medical Research   ii. Convalescent Care

ii. Rehabilitation Service   iv. Long term care

v. Diagnostic and Treatment Service. vi. Preventive Health Service.

But in relation to built form, all Architectural designs still had roots in forms that had gone before and was evaluated in relation to the known use, tested structural solutions and prevalent decorative details. Also buildings were evaluated on the basis of reactions of those who experienced them.

The twentieth century architect changed that. A new set of principles were proposed that grew directly out of acts of Architecture and were seen to have a pre abstraction independent of human experience. (3)

Improved technology and the bridging of the communication gaps made sure that India did not remain untouched by these advances both in medical science and the field of Architecture. But with this onslaught of modern knowledge, the traditional medical knowhow which was being carried from generation to generation somehow got side lined. And people somehow forgot that India is a land of, not only Ayurveda, but also of many alternate medical sciences like mind therapy, aroma therapy, etc. And with this was forgotten the very basis of the success of all these practices. The basis was the establishing of a bond between the patient and the doctor, which led to understanding of the psychology of patient and after that the doctor prescribed medicines. This is why these practices were practiced in small laboratories and clinics, and mass-treatments were not undertaken.

The New Direction - Psychology

The need for the study of human psychology and its behavioural patterns for architectural ventures had been felt a long time back. Since then attempts of environmental social scientists and other architectural theorists has been to relate the experience of places once again to abstractions of building layout and form and in doing so, to enable architecture to take it's place once again amidst the communicative arts.

Talking about the human dimension in architecture, K. Izumi offers a diagram useful in understanding the meshing of human and non human components in the architectural fabric. (4)
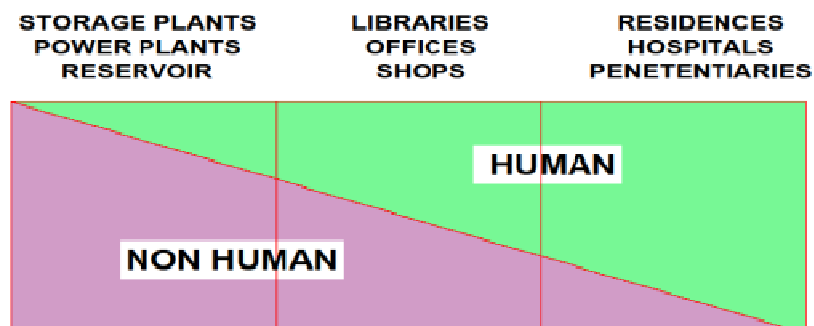
Here, the rectangle represents the environmental design as related to buildings, with a diagonal separating the human and non-human factors, has been further divided into three parts, representing different types of buildings, according to human factor to the building concerned. As we move from left to right in the diagram, the evaluation of building becomes more weighted towards performance, as a social setting and against exclusively visually aesthetic properties.

As far as our study is concerned, hospitals fall in the rightmost rectangle. A thorough understanding of patients psychology is therefore must before designing a place to heal them.

But psychology in itself presents an interesting situation. What one perceives consists of a transaction between what is there physically in the real world, stimulating one's sensory receptors, and the thoughts or ideas which one has already inherited at birth or particularly learnt from one's past experiences. (5)

Research in human psychology show that humans interact with three quite distinct worlds - the ordinary physical world, the mental world, and the world of actual or possible object of thought - the world of concepts, ideas, theories arguments and explanations. The last one undergoes slow evolutionary changes. The change is gradual, directional and integrative in the sense that it builds a new upon whatever level may have been achieved beforehand. (6)

Also, Charles J. Holahan says "The effect of environment on the human behaviour instead of appearing direct emerged as mediated by a diversity of adaptive maneuvers and stratagems... human activity in environmental contexts presented itself as constantly creative and surprising". (7)

This talks about a dynamic quality of this effect where the relationship between the two keeps on changing with time, place and context. (8)

Major factor while understanding the building and the society has been to make visible, and articulate, the fact that people, as social objects, do not have one identity, but rather, multiple identities; in different contexts, they operate as gendered objects, class subjects, or national subjects, belong to different ethnicities, races, professions, or possess different political and sexual orientations.

So, significance of a place is enshrined neither in its particular physical form, nor in the particular people but rather an inter play between these two. Indeed, the Operation Theatre may seem like just another to the Surgeon who has spent his or her life working in such settings although it may strike fear into a patient.

Hence a thorough understanding of patient psychology and their behavioural pattern is a must for designing a place to heal them, the Hospital.

Environmental Stress

It can be defined as an internal state which can be caused by physical demands on the body or by environmental and social situations which are evaluated as potentially, harmful, uncontrollable, or exceeding our resources for coping. The physical, environmental and social causes of the stress state are termed as stressors. (9)

Six qualities of environment most likely to contribute to stress are:

- Physical threat - Exposure to elements, that is, excessive heat or cold conditions, filth, etc.

- Suitability of environment - The ability of the environment to support or frustrate people's goals. For example, buildings with way finding problems.

- Stimulus Information Overload - This results from an unpredictable or uncontrollable surroundings. This includes individual's relationship to the environment, based on personality type, cultural expectations or conditioning, and personal goals.

- Social and Psychological - Environments are coded with messages that convey feeling of social worth, security, identity, and self-esteem, as well as indication of status.

- Demands of the environment - Amount of effort, energy or resources required to interact with it. This can mean physical effort, time or money. An example might be stress associated with the cost of hospitalization.

- Stimulus or Information deprivation - This occurs in isolated environment. To function normally, people need interaction and the resulting tensions and challenges.

Need Identification

In the last two decades there has been a perceptible and a sudden change in our society, from its slow, sluggish contented pace to a much competitive ambitious and consumer oriented atmosphere. The new goals and urges put severe stress and pressure on individuals living in such a society. All this, in addition to the pollution, unregulated food habits, etc. has had a marked influence on the general health conditions.

Also in this era of consumerism, people are more aware and play an active role in keeping themselves fit, and shop for health care services with a critical eye. Even the escalating costs are accepted as a matter of course. This has made the role of hospitals and the environment they generate much more important. And the primary function of hospitals has turned slowly from

custodial care to active intervention. These are now places where not only life could be saved but the quality of life is also improved.

Also it has been realised that understanding the indispensable trait of man to relate to architectural forms in a dynamic, constantly changing manner can be of importance to architecture and related studies. This dissertation is aimed at understanding aforesaid factor and its viability in the contemporary Indian Hospital Architecture level.

Aspects Of Human Psychology

➢   **Physical Environment**
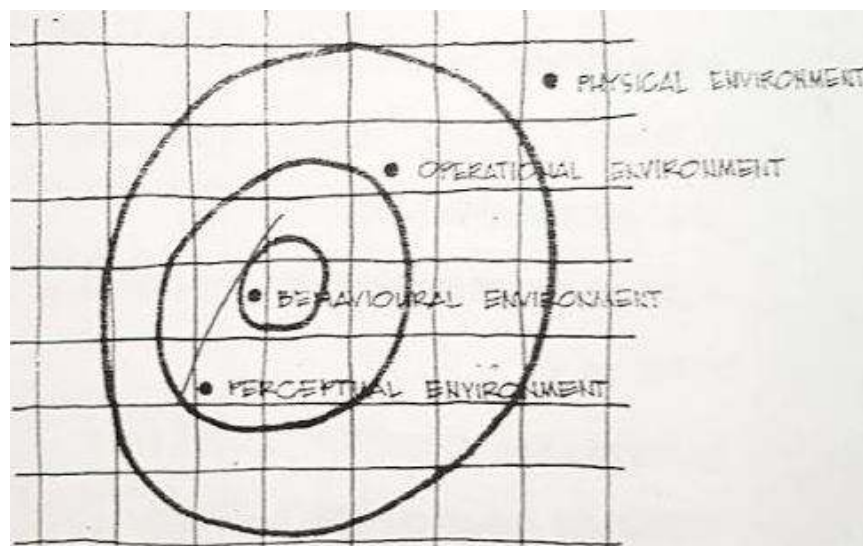
The complexity that constitutes any physical setting, in which men live interact and engage in activities, is the basis for the concept of physical environment

Within the physical environment, there is an operational environment within which people work and which affects them. Within this is the perceptual environment, of which people are conscious directly and to which they give symbolic meaning and within that is the behavioral environment of which people are not only aware but which also directs behavioral response. (10)

Satisfactory physical environments are those which allow for desired pattern of behavior and at the same time inhibit undesirable ones. These settings should also be able to respond to changes in patterns of human behavior. Behavior patterns in this context mean much more than just activity patterns. It includes such factors as interpersonal communication, the personalization of space and environmental symbolism.

Components Of Behavior

➢ **Cognitive Component**

People are able to act in relationships to their environment and the world because they have some plan in their mind, some programme to direct their behaviors, and to adopt it, to meet the situations which they encounter. This image building results from a selective and unique conception of cities in which people live, schools and hospitals they frequent, routes they take to work, and so on. These in turn influence how they use, move about in and feel about the space. (11)

Environmental image has its original function in permitting purposeful mobility. Also in addition to its role as a mental setting for thoughts of action, environmental images function to organise our perceptions. Thus, they permit us to code, structure and store visual and spatial information and directly mediate and regulate our responses to the things we see.

In India, people were used to visiting 'Vaids' for their ailments and with him they shared an intimate bond of complete trust. After Independence, the latest technology and medical know how reached the grass root levels but this development was so drastic that people had doubts over its usefulness. This resulted in a self-imposed barrier in people's mind. Over the years, although people have become aware of usefulness of the modern medicine, the image that people carried of a hospital has worsened, mainly because of indifference of the staff-members, and lack of awareness among the hospital planners and designers regarding the importance of user-psychology.

But what we cannot ignore while discussing the concept of mental imagery is that richness of our environmental experience directly influences the scope, character, and utility of our comprehension of the world.

➢ **Variance**

This is the term used in behavioral science in considering the relative influence of a set of causal factors on behavior. To attribute too much variance to the physical environment as opposed to social, cultural, and psychological variables is to ignore the complexity of human behavior on the one hand and the total environment on other. (12)

➢ **Multilateral Nature**

One of the important aspect of behavior is that physical environment very rarely acts as unilateral as it does, for eg., in a flood. Actual environment is in constant interaction with the human beings defining or managing spaces and humans may participate actively in the use or modification of space.

➢ **Need For Privacy**

Harold Proshansky defines privacy as not simply the direct opposite of crowding, but more specifically, as an individual freedom to choose what and to whom will he communicate about himself in a given circumstance. Lack of privacy rates high as a source of stress among patients in a Hospital. A study at the University of Michigan Hospitals found that even if cost were no object, 45 percent of patients would choose a private room, 48 percent would choose a semi-private room, and 7 percent would prefer a multiple bedroom. (13)

➢ **Territoriality**

This can be explained as a sense of control over your own physical setting. It is as much a group concept as it is an individual concept. Group function and process is facilitated if group members can satisfy their desires for a place both for the group and for themselves as individuals. Issue of territoriality, when considering a patient, is a complex one and perhaps should be interpreted as a need for control rather than the desire to be alone.

➢ **Competence**

It is a measure of an individual's health, sensor motor functioning, cognitive skill and ego strength. It is an entity of definable reality.

➢ **Stress**

It can be defined as an internal state which is caused by physical demands on the body or by environmental and social situations. The physical, environmental and social causes of the stress are termed as stressors. (14)

Mechanism Of Stress

After exposure to a stressor the general adaptation syndrome involves three stages-

• An A**larm reaction** is the initial response, a marshaling of the body's defense mechanisms.

• A stage of **Resistance or Adaption** follows because no living organism can continuously maintain itself in a state of alarm.

• After prolonged exposure to the stressor, the organism's adaptation eventually fails and third phase, the stage of E**xhaustion**, ensues. Symptoms at this stage are similar to those in the initial alarm reaction phase.

Regardless of where the stressor initially acts, it eventually produces a generalized stress reaction in the entire body. This debilitates the immune system. Suppressive effects on immune

functioning causes susceptibility to disease and can potentially impede recovery. Various factors such as heredity, diet, previous experiences, exposures and attitude can predispose or enhance vulnerability to stress.

Stress And Illness

In 1936, Australian physician and scientist, Hans Selye, pioneered a new frontier with his revolutionary discoveries about stress. His study demonstrated that hormones released during stress participate in the development of diseases, including brain hemorrhage, hardening of arteries, coronary thrombosis, certain type of high blood pressure, kidney failure, arthritis, peptic ulcers and cancer. (15) Till then stress was considered an external force. His definition referred to wear and tear on the body from its attempts to cope with environmental stressors.

Many researches have shown that stress causes a number of significant physiological responses including the release of numerous hormones, elevated blood pressure and heart rate, increased muscle tension, construction of blood vessels, gastric disturbances and suppression of the immune system.

Factors Affecting Behavior

➢   **Light**

"Licht Und Finsternis fuhren einen bestandingen Streit

initeinander." (J.W. Goethe)

Light is so fundamental that it has come to symbolize life itself just as its opposite, darkness, symbolizes death. (16)

Light is known to affect hormonal and metabolic balance and entertainment of body rhythms. In fact, Neuroscientist Richard Wurtman believes "Light is the most important environmental input after food, in controlling the bodily function."

Nurses at Fresno Community hospital, California found that they had more energy, higher production, greater ability to solve complex problems when lighting as changed. Some of the other benefits of proper lighting are shorter reaction times. better visual activity, less physiological fatigue, and overall improved task performance. (17)

➢   **Color**

Researches show that there are specialized energy centers called Chakras all over our body; each of which is associated with a major nerve and glandular centre in the body. Energy threads, nadis. connect the chakras to each other and to various aspects of physical body forming the

Chakra-nadi network. An understanding of chakras and their higher energetic links to body physiology helps to explain why certain colors are used to heal specific illness.

Some examples of colors meant for specific disorder (18):

Violet   Nervous and Mental disorders

Indigo   Eye disorder

Blue   Thyroid disorder

Green   Heart disease & Hypertension

Yellow   Disorders of stomach, pancreas, liver

Orange   Lung and kidney disorders

Red   Blood disorders and anemia

- ➢ **Aroma**

Olfactory sense is often under-estimated both as a cause of Stress and when used as therapy. Unpleasant odors are known to increase heart rate and respiration. whereas pleasant odours have an opposite effect. (19)

Researchers have shown that olfactory messages reach the brain faster than aural signals. Research at Yale and Duke has demonstrated that sniffing specific floral and fruit fragrances slowed respiration, lowered blood pressure and heart-rate, and relaxed muscles. Recent research conducted at Milan University has shown that essential oils are effective in treating anxiety and depression. (20) Indian beauty therapists like Shahnaz Hussain and Blossom Kochchar are practitioners of this therapy.

- ➢ **Music**

Music is believed to affect deep areas of brain-tissue producing extreme pleasure. Over the years, music has been used to help treat depression, to reach autistic children and to relax agitated psychiatric patients. (21)

Music can have analgesic or pain-killing effect and soothing music reduces risks of hypertension, stroke, and coronary heart disease.

- ➢ **Chronobiology**

As physicians probe increasingly subtle approaches to treatment and therapy; they reach that rarefied domain where human biology and meta physics meet, as in the emerging field of Chronobiology.

Studies have shown that there are best and worst times to administer every drug. Also some diseases seem to occur more frequently at certain times of day and during certain seasons. For example heart attacks are twice as likely to occur shortly after waking up. (22) Researchers are discovering previously unrecognized internal rythms; eg. the viscosity of blood rises and falls on a 24 hr. cycle.

It is interesting to note that after years of focusing on medical technology, physicians are starting to explore and appreciate the human body's responses to metaphysical forces, theories hinted at by healers centuries ago.

➢ **Landscaping**

Landscape is largely a visual and spatial interpretation.

Plants enframe views, soften architectural lines, enlarge and compliment architectural elements and unify divergent elements. It also introduces naturalness to otherwise stark settings thus promoting feeling of well-being, and hence reassuring the patient.

➢ **Noise**

This can never he ignored while discussing various stress factors. It provides a generalized stress reaction that can increase blood cholesterol levels, lowers individual's pain threshold, and impedes healing because of disruption of sleep.

Art As Therapy

"Art is an expression of humanity that carries the legacy of a culture and touch and stir an individual at the time of his deepest need to help him transcend his pain." (23)

Health Facility Planning - Introduction

History of Hospital construction for modern medicine in India dates back to 1770, when the first hospital was established in Calcutta. Since then, the planning and design of hospitals has not experienced a systematic development but has rather reflected, with suitable adaptation, what's happening in the west. The resulting designs were, by and large, indifferent to the socio cultural values and attitudes of Indian users to western medicine.

In 1987, India became signatory to the **Alma Ata Declaration of 'health for all by the year 2000'**. Today, after eighteen years of this deadline, the health care industry is still experiencing

the turbulence of sweeping changes in planning, management and financing, because of the chronic inadequacy of existing system in providing an integrated health care service.

Architects have a very important role to play in this highly specialized, function oriented and management controlled building type, but, we face a difficult task because:

- India has only recently seen the recognition of hospital planning as a specialized field. Hence, lack of any systematic research documentation in this era is one of principle short-comings that an architect is faced with today.

- Architects have failed to recognize that planning and designing for health care is more a process of organizing a series of strategies and tactics that continually respond to the pressures both within and outside the specific area of their profession, rather than treating the process as a single climatic.

- The overpowering functional capabilities, state-of-the-art medical equipment are often misrepresented as state-of-the-art hospital planning. The real danger is that of the architect playing second fiddle to the equipment vendor, unless his homework extends beyond selection of the wall paper.

- Lack of awareness among the hospital planner and Architects regarding the potential capacity of environmental psychology to provide a body of knowledge, conceptual and empirical, for understanding the relationship between patient recovery and his experience at the built environment that he is fastened in.

Organization

All health care delivery comprise a range of institutions which, at least in theory, are graded according to their degree of sophistication and specialization and the level of care they can provide.

- Primary Care - It embraces all the general health practice services, educational, preventive and curative, that is offered to the population at the point of entry into the system.

- Secondary Care - It comprises of more specialized services to which people are referred by the primary care services.

- Tertiary Care - It includes highly specialized services not normally found at secondary level. Including super specialties such as plastic surgery, heart surgery, etc.

Design Dilemma

Rational discussion of hospital design is complicated by the fact that hospitals are connected with matters that affect life and death. Once these absolutes are mentioned, normal methods of evaluating results became difficult to apply; when life is at stake people naturally feel that 'only the best is acceptable'. It is generally assumed that more sophisticated modem procedures automatically justify a correspondingly heavier investment in building and engineering. The latest technology is embraced, even if it affords no economics in output and the efficiency of treatment has yet to be proved. Also over the years an interesting tussle between Architects (believers) and scientists (challengers)has been going on. Science involves testing theories according to certain rules of evidence. The scientist does not question whether something is true but whether it can be proved according to specific criteria. This approach may not be valid when dealing with Architecture because various aspects of architecture can be experienced and not measured quantitatively. Here behavioral outcome of experiencing the space is significant.

At this point growing field of **Environmental Psychology** comes as a pleasant help-factor to bring out the designer from his design dilemma. But here they face problems because of the hassle of controlling different design variables.

Important Design Variables

➢ **Scale**

This refers to how we perceive the size of a building element or space relative to other forms. The size of each element is perceived relative to the Size of other elements around it. The scale of a building is very important while considering creating of humane settings. The built form should not be too imposing which can impede recovery. The factors that affect scale of a building are the shape, color, pattern of bounding surfaces, the shape and disposition of its openings, and the nature and scale of the elements placed within it.

➢ **Relationship Between Indoor And Outdoor Spaces**

Interrelationship between them is important because it provides opportunities for the patients to respond to elements that have been important to humans throughout million of years: water, sunlight, trees, animals and plants.

➢ **Interior Finishes**

Usage of different materials with different textures, form and color lends a positive variety to the architectural setting. Ease of maintenance and life-cycle costs have to be the primary considerations, after safety issues have been resolved.

➢ **Acoustics**

Sound can be negative if it is perceived as noise and cannot be controlled. In fact, noise is one of the most significantly detrimental environmental factors known to cause physiological changes in the body and affect healing. Every effort should be made during the design process to anticipate sources of noise and find ways to mitigate them.

➢ **Lighting**

Light is another highly significant environmental factor, whether natural or artificial. In patient care areas, rendering the skin as realistically as possible is important. Also the lack of proper light causes depression, moodiness and even a craving for carbohydrates.

➢ **Architectural Legibility**

This deals with the ease of way finding within the building. The three key issues are overall orientation, identification of specific rooms and the cueing of restrictions Its necessitates knowing one's present location, knowing where one is going relative to the present location, and knowing how to get to the desired destination.

Developing Healing Environments In A Hospital

➢ **Noise Control**

The following should be properly taken care of:

• Sound of footsteps in corridors.

• Slamming doors, clanking latches.

• Loudspeaker paging system.

• Staff conversations from nurse-station or staff-lounge.

• Other patient's T.V. and radio set.

➢ **Air Quality**

• Need for fresh air, solarium or roof-garden.

• Avoidance of odiferous cleaning agents.

• Adequate number of air changes.

➢ **Thermal Comfort**

Ability to control room temperature, humidity and air-circulation to suit personal needs.

➢ **Privacy**

• Ability to control view of outdoor.

• Ability to control social interaction and view of patient in adjacent bed.

• Secure place lo personal belongings.

• Place to display personal memtos, etc.

➢ **Light**

• Non-glare light in patient's room

• Ability to control high intensity

• Provision of good reading light.

• Window should be low enough for patients to see outdoor while lying.

• Patient-room should have light in full spectrum.

➢ **Communication**

• Ability to contact staff when needed

• Comfortable places to visit with family.

• T.V., radio and telephone available as needed

➢ **Views Of Nature**

• Views of trees, mountains or ocean from patient rooms and lounges.

• Indoor landscaping can be used as a major tool to improve environs.

➢ **Color**

• Careful use of colors to create mood, lift spirits, and make room cheerful.

• Use in linen, personal hygiene kits, accessories, food-trays. etc to enliven the overall ambience.

➢ **Texture**

Introduce textural variety in wall-surfaces, floors, ceilings, furniture and artwork to establish immediate rapport with the user.

➢ **Accommodation For Families**

Provide place for visitors to make them feel welcome, rather than intrusive.

Provide access to vending-machines, cafeteria, telephone, etc.

Evaluation Criteria

For evaluation, a few patients in local Govt. hospitals of Jammu were talked to. The various spaces were analysed under the following aspects.

- **Complexity and Unity** - This is a matter of how well, the various parts, whether of visual, auditive or tactile nature, fit together into a coherent and functional unit. It is the measure of unity in the physical environment. If complexity is far exceeded by unity, the result is a dull and monotonous environment; whereas if scale did the other way, the environment may appear too chaotic.

- **Pleasantness** - This is a measure of how comfortable the inmates are inside the, physical setting. This includes various feature in Architectural settings such as massing, scale, colors used, lightness, texture, articulation.

- **Open and closed spaces** - This deals with the attempt to inter play between the open and closed spaces in order to create conducive atmosphere for the patient.

- **Potency** - This deals with the ability of the built form and the physical environment within, to make the patient feel secure and in charge of himself and his surroundings.

- **Social status** - This deals with the Architect's preference for expensive and exclusive rather than cheap and simple It is a measure of how comfortable are the patient's from various social and financial background.

- **Affection and originality** - This implies a kind of recognition an impression of familiarity that the patient's feel towards the various spaces inside the hospital. It further studies the architects attempt to explore various innovative and original options possible within the existing mental frame.

Conclusions

The experience of hospitalization is a source of psychological stress for most patients, regardless of the nature of the illness. Researches suggest that the design of the physical setting has an

impact on both patients and caregivers. Obviously space planning greatly impacts function and case of circulation, but more subtle are psychological messages encoded in the environment

Hospital Stress Factors

* Unfamiliarity of surroundings.

* Loss of independence.

* Separation from spouse.

* Financial problems.

* Isolation from other people.

* Lack of information.

* Threat of severe illness.

* Separation from family.

* Problems with medicine.

Having exposed the factors affecting the psychological behavior of patients/visitors and having examined the qualities of healing environment, here are a few suggestions about certain principle spaces that influence patients and visitors evaluations.

Suggestions

➢ **Lobby**

* It is the patient's or visitor's introduction to the hospital. and the design of this space sets expectations for the quality of clinical care.

* On arrival in the lobby, the information desk and admitting department should be visible. The lobby and the hospital's main entry corridors must be architecturally legible and readily navigated by a wide variety of visitors. These measures help to ease the patient's or visitor's anxiety on arrival.

* A variety of seating options should be provided. This allows visitors to select one that satisfies individual comfort requirements. Also seating should be grouped to ensure privacy.

* A variety of light sources, both natural and artificial, can accentuate the architectural form of the building.

- Art collections can be utilised as a component of a healing environment.

➢ **Visitor And Patient Lounges**

- It should offer a variety of seating, a television viewing area, and a variety of lighting to accommodate reading, conversation or playing games.

- The location of lounge and its size depends on the beds it serves and the layout of the nursing unit. A lounge is also a refuge for patient's who cannot sleep and wish to relax without disturbing their room mates.

➢ **Patient Rooms**

- Their design is very important because for many patient's it is the only room they see during their period of hospitalization.

- To make the environment enhance healing the patient should have views of nature (from the bed), he able to control lighting levels, have control over room temperature and privacy, not have to suffer noise of carts or conversations in corridors and be, surrounded by a moderately stimulating palette of colors and texture.

- Some important aspects of patient room which can never be ignored:

1. **PRIVACY AND ISOLATION** -. With respect to visual privacy, the essential point is always the tradeoff between the patient being able to see into the corridor and yet not seen by passerby. Here the need for quick staff access to patient for treatment should not be ignored.

2. **ROOM LAYOUT** - This is very important aspect of a patient room. Layout having beds placed toe to toe on opposite head walls give both patients equal window access and makes maneuvering equipment easier. But this may force patient's to stare at each other unless they pull the privacy curtain. Beds placed side by side do not afford equal access to window and visitors to window bed are forced to intrude upon the privacy of the other patient.

3. **LOCATION** of the bathroom in the corridor wall maximizes exterior views but can block the view of patient's head and force the nurse to walk into the room to observe the patient.

➢ **Nursing Unit Design**

- It's design criteria revolves around maximizing nursing efficiency and patient centered care.

- The design of a Nursing Unit is very important because it can influence nursing staff behavior, including frequency of interaction with patients and families travel time, staffing requirements, infection control practices, satisfaction with the ability to carry out treatment, surveillance, communication and satisfaction with the work setting.

- Nurse's stations need to be large enough for a number of nurse's to work side by side and for physicians to do charting.

➢ **Emergency**

- Individuals requiring emergency care are under tremendous stress. The nature of these injuries is that they are sudden and unexpected, the life and death aspect causes their companions to experience tremendous stress, Therefore. clearly marked emergency entrance roads and drop off points are very important.

- The approach to the emergency room should be clearly marked and visible for vehicles traveling from any direction. Being confronted by confusing traffic patterns on the hospital campus upon arrival can be overly taxing and dramatically add td the stress experienced by driver and patient.

- Many people become uncomfortable and extremely nervous watching an ambulance unload patients. Therefore. the ambulance entrance should be visually screened from the passenger vehicle entrance. Neither of the emergency drop off entrees should be visible from the main lobby.

- For the assessment or evaluation of patient's conditions to help privatise those needing treatment, the registration desk should provide privacy and visual separation between patients.

- The period of time spent in the waiting room may be extensive. So it requires, natural light and calming colors, comfortable waiting area with telephones, and vending machines or other access to food.

- Lighting should be indirect and of a color temperature that is flattening to skin tones.

- In treatment areas, good visibility of treatment bays from NS and easy access to patient's room are critical.

- A separate patient waiting area may be provided near treatment bays, allowing good visibility from the nurse's station.

- Natural light, views of nature, outmark or any other diversion that may help to calm frightened patients would be beneficial.

After analyzing various hospital spaces, we get three basic principles which can be considered absolute necessity while designing spaces to foster patients.

Design Principles

➢ **Freedom Of Usage**

The design should maximize the freedom of its users to choose the way they live.

This stresses on the need for involving users, in the design and planning of a health faculty. User participation can have several benefits, including enhancing their awareness of the environment inside the Hospital, ensuring their commitment to the final outcome and making certain that all clinical needs have been adequately reviewed and factored into the need.

This freedom can be actually traced back to most primitive societies, when the builder was himself the user of the environment. Then the choices were based on tradition, evolved in response to social and cultural needs. Even later in history. designs reflected client's needs and the builder still built for people with similar needs. Industrial revolution changed this trend. Since then, most environments have been designed and built for clients other than user - shopping by merchandise's and not shoppers, hospitals by technical staff and not patients, schools by educators not students, etc. So need is for increase in user control following the old traditions.

➢ **Need Of User**

Needs of patients should be defined in terms of underlying social meaning of behaviour and attitudes in them rather than merely in terms of what others believe they need.

'Functional' has been a catchword among designers, since the turn of the century. But the term function has several meanings. For eg. the Bahauas and the Modern movement in Architecture used the term function to describe the use to which an object was put to. E.g. furniture to sit on, cars to get places in. etc. But there is another side to these things. Furniture is as much an expression of its owners life style as it is a thing to sit on. Cars are as much a means by which men establish themselves in society as they are a form of transportation. So there is a hidden function of these objects, called the latent function.

Spaces and the behavior that take place in them can thus be described in terms of both their manifest function and their latent function. While the manifest functions of most spaces and their

behavior is atleast superficially similar for different social and cultural groups, then latent functions often differ. Thus the identification of both the manifest and the latent meanings of various spaces inside a Hospital is very important for patient friendly health facility planning.

➢ **Design Of Spaces**

The behavioral and perceptual opportunities provided

by the physical surroundings should accommodate as much as possible the needs of the users.

Once the manifest, as well as latent, function of spaces and their behaviours have been determined through research, needs of users should be given due respect; and designing should be done around a set a social needs, rather than conflict them.

➢ **Leap Of Faith**

Environmental psychology, a relatively new field, offers the promise of building the gap between researchers and designers. Its relevance is even enhanced for a built form. associated with life and death, the Hospital.

Coming years will no doubt increase the quality of environmental research although the elusive qualities of architectural space will remain difficult to measure. To paraphrase Robert Sarnmer (1903), perhaps a leap of faith is required to be able to overlook hard evidence in order to concentrate on experiences and behavior and know that they have some casual relationship to performance, however difficult it is to measure. Rufold Aruheirn (as reported in Sommer, 85)

Comments:

"The qualities that carry value can be described

with considerable precision. But many of these

descriptions cannot be quantitatively confirmed by the

measuring or counting of data. They share this trait

with many other facts of mind and nature, and it does

not prevent them from existing or being important. Nor

does a lack of numerical proof exclude them

from objective discussion. The 'extensive' method of arguing

with the index finger by pointing to perceivable facts,

<div align="center">
making comparisons, and drawing attention to relevant

relations is a legitimate way of furthering

understanding b common effort." (l)
</div>

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GENDER BASED MAPPING OF URBAN PUBLIC SPACES.
A CASE STUDY OF LAL-CHOWK, SRINAGAR

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Abstract: "They (Kashmiri women) have supported the Azadi sentiment, fought for their place under the sun, protested and demonstrated in rallies while seeking justice for their men, and provided a motherly haven to their children."

–   The land I dream of – The story of Kashmir's women
This study aims to examine the gender concerns and needs in the identified public space of Srinagar, Kashmir. It will analyze the existing problems faced by the women in Kashmiri community and how gender-equality/inequality affects their inter-relationship with these public spaces. The nature of the topic dictates the use of both qualitative as well as quantitative data to identify the factors for an improved use of public spaces and increased economic, networking, cultural and social activities. It is critical to take into consideration other factors like the socio-political scenario (Kashmir conflict), a Muslim dominated society, extreme weather conditions etc.

Introduction

Public spaces are closely interlinked with the quality of life and the image of a city. They act as a 'self-organizing public service', a shared resource in which experiences and value are created. (Mean and Tims, 2005) It is a vital part of everyday urban life that plays a crucial role in providing cities with key support for social interaction, cultural expression and economic activities.

In the book "Why loiter? – Women and risk on Mumbai streets", the author talks about constructions of gendered spaces and how men and women use them differently. It is possible to generalize that across locations and time, one specific characteristic of gendered public space is that it often excludes women. This exclusion operates in complex ways so that different women have differential access to public space. This may lead to environments that disadvantage

women and often do not meet their needs. A more explicit consideration of gender is needed in both how planning is delivered and in its wider impacts.

It is argued that the integration of gender into spatial policy-making would result in a more sustainable, equal and accessible built environment for all members of society (Greed, 2005). If women are discouraged from using public spaces it will not only lead to a homogeneous environment, but will also hamper their participation in economic as well as leisure activities.

The idea of this study is to raise awareness and highlight the importance of taking gender into account in the planning process. When planning takes into account the different needs of women and men, it will lead to an equal participation by both men and women which in turn will lead to expanded economic, social and political opportunities. They should have the power to shape their cities and by gender sensitive planning we can move a step closer towards sustainable planning.

This study aims at focusing on the identification and prevention of factors that lead to exclusion of women and girls in terms of their access to public space. The area chosen for the purpose of this study is:

- Lal-Chowk (CBD of Srinagar)

From left: The Clock Tower before, while and after beautification

From left: Lal Chowk precinct, viewing west; Lal Chowk, viewing east

Today Lal Chowk has grown into a major business place with formal & informal activities making it a vibrant city centre

Source: Google Earth

Figure 1 : Identification of site

Women and urban public space

Women's concerns and fears should be used as an input for planning and design.
Public spaces should be planned to encourage equal social relations between men and women It is important to integrate women's needs and interests when defining land zoning and city

planning at the macro level. Making cities and communities more accessible and safe for women and girls can expand their full social, economic, cultural and political participation as equal citizens.

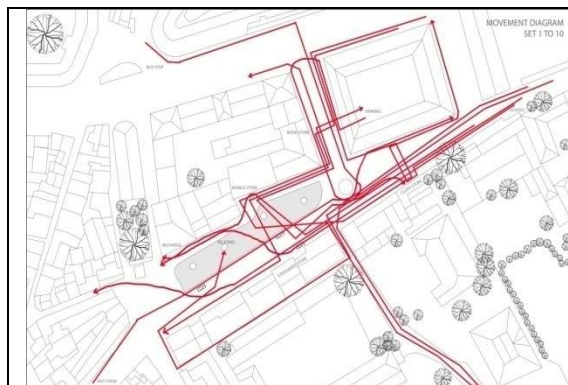

Figure 2: Methods used for data collection

Figure 3: Movement diagram	Figure 4: Crowd mapping

Lal Chowk is a pure important public space – a power centre. It has the capacity of focusing inward at one point and also duplicate to release pressure outwards. Factors such as sex, age and ethnic identity as well as class and income affect the way in which urban life is experienced (McDowell, 1999; Vaiou, 1999).

The public space plays a determining role in the symbolic efficacy of a place. It is both a space of freedom (free circulation, contact between the sexes, different age groups, different social classes, exchanges of ideas, goods and services, etc), and also a space of public constraint (the sphere of application of rules and social norms, of laws on morality and order, etc). The public space is therefore that in which it is possible to gather the largest number of people sharing the same codes, the space in which a message can reach everyone, and in which the public power has the right to intervene to enable its delivery (Monnet 1993:195).

Conclusions & recommendations

Using data derived from survey of general public of lal-chowk, two empirical questions were addressed:

- What constraints to **access to public space** do women & men experience and

- How does the context of **personal & situational circumstances** (eg. Age, occupation, sociocultural background) filter the effects of constraints among genders.

Several differences emerged between women and men in terms of the intensity & nature of the constraints, leading to the conclusion that **women are more constrained** in terms of inclusion in the identified public space.

In any society, women – consciously or unconsciously strengthen existing social structures. In J&K, they do so much more. Contrary to popular perception, women's issues are not a 'soft' subject matter, but a plethora of complex themes with unimaginable parameters, and this is especially true of women in J&K. Living amidst the chaos, confusion, turmoil and trauma of a prolonged conflict, the people have had no choice but to endure what came their way. One dimension that has been missing from the national and international radars is the impact of the conflict and violence on Kashmiri women and the fact that they had to take on so many roles in the absence of their men, leaving them with almost no space to mourn the losses they have suffered. The women of Kashmir are the most affected and silent sufferers of the extended turmoil.

In the context of Kashmiri women, Agha Shahid Ali's lines in 'The Wolf's postscript to Little Red Riding Hood' hold good:

First, grant me my sense of history:

I did it for posterity,

For kindergarten teachers

And a clear moral:

Little girls shouldn't wander off

in search of strange flowers,
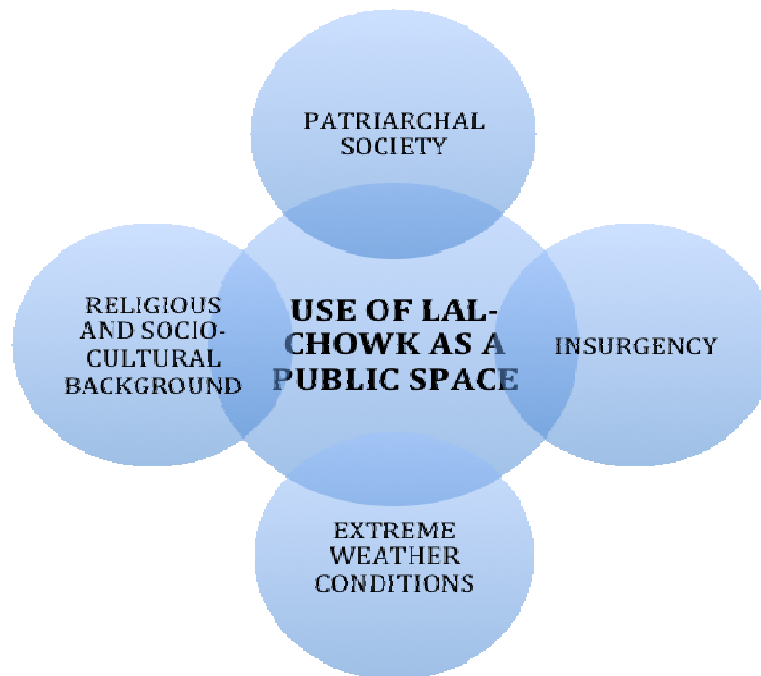
and they mustn't speak to strangers.

Figure 5: Intangible factors

In the context of Srinagar, the patriarchal structure of an average Kashmiri family and society gives men considerable authority and protects them. The society grants men power in the family sphere as well as in the public sphere, and uses various means to safeguard it. This principle is clearly seen being applied in the identified study area and it's effects trickle down right up to the roots. The study has also sought to know whether men are aware of the hierarchy that is being promoted in this public space, knowingly or unknowingly and what is their take on it. In a society that deems the rightful place of a woman at home, it doesn't come as a surprise that men don't see this unequal access to public space for men and women as unfair or unnatural in any sense.

Women are not even spending close to one-third the time men dedicate towards leisure activities in Lal-Chowk. Women are subject to economic constraints and discrimination, which are usually imposed on them to a greater degree than men, both within and outside of the family. The patriarchal and sexist structure of the society can in turn discourage women to claim their rightful space in the city.

The scope and concepts of gendered space is an upcoming field but he most crucial aspect of the study is the context of the delineated area that makes this case exclusive. Much research remains to be done on the larger social attitudes and the past and possible future trends in this domain. Other directions for future research that can be taken may include urban public spaces from the

planning, policymaking and designing perspective and how the inclusion of women in the decision-making process yields different outcomes.

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