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RESEARCH ARTICLE

Development of Rural India: From wired to wireless network- A comparative study.

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Abstract

The Knowledge Information Sharing plays an important role in rural development. The Empowerment of rural communities is essential for the development of the rural region. The major concern is nowadays to bring the people of rural region to digital technologies for access and implement modern technologies. Here, meaning of Rural Development implies both, the economic development of the community and increase social revolution using electronic governance (e-governance). In order to provide better prospects and opportunities for development in terms of economic, agricultural and marketing management, participation of rural people, usage and adoption of information and communication technologies (ICTs) should be increase in India. Purpose of this paper is to explore the nature, role and significance of the Electronic/Digital Governance and wireless technologies for rural development in the rural areas. It also aims to study the impact of e-governance on rural development. The paper examines the current status of electronic governance in India.

Introduction:-

In many developing and developed countries, various rural regions do not have good connectivity. Till now, networking research has mainly focused on urban areas of the industrialized world. Connectivity is major factor for growth of India in many aspects of society. Information technology is growing rapidly in India. But a few percentage of India's population are using internet connection at their residence. India has more than 9000 approx internet cafes which enable communication and interaction with others in e-governance through ICTs and wireless technologies such as, e-mail, audio/video chat, conferencing etc without interruption. People can also utilize various public services to gather information about education, jobs, technology etc through the Internet. Indians are usually very passionate about the Internet. Due to lack of awareness, physical connectivity or telecommunication infrastructure, unaffordable cost and broadband technologies only a small number of persons can use the Internet. India is developing country but rural India is lagging in development in terms of education, health, entertainment and the general living standard due to lack of Government support, that is our dark side. By creating ICT and Wireless infrastructure rural regions can be developed. India is a land of geographical diversities and there is comprehensive wired communication infrastructure we are using today that must be replaced by wireless infrastructure.

Broadband Technology:-

There are verities of broadband technologies (Priya et. al, 2014), such as cable, DSL, power line, satellite, and wireless. Each of these implementations can provide similar services to consumers and businesses.

Generally broadband service delivery can be separated into two main categories: Wired and Wireless. Wired broadband delivers services over some type of wire connected around the area. Wireless broadband uses the electromagnetic spectrum and does not require a wire over the area.

Wired Broadband

- Dial-up
- Digital Subscriber Lines (DSL)
- Cable
- Leased lines (T1)
- Broadband over Power line (BPL)
- Fiber optic cable etc.

Wireless Broadband

- Fixed wireless
- Wi-Fi
- Satellite
- Wi-Max etc.

The primary reasons (Laxminarayan et. al, 2006) for the booming the uses of long range wireless networks within developing countries are:

Low-cost and decentralized evolution:-
In developing countries, wire-line connectivity solutions are not economically feasible in low-user density areas (S.M. Mishra, 2005). A much lower capital investment is require for establishing wireless distribution networks (microwave, WiMax, Wi-Fi based or CDMA450) to expand coverage within a region. This allows rapid evolution of decentralized networks by local entrepreneurs. Among different wireless options today, Wi-Fi based networks are *currently* much more economically feasible than WiMax, CDMA450 and microwave.

Ease of deployment:-
Wireless networks are comparatively easy and quick to deploy, particularly where towers setup in somewhat complex. Networks in unlicensed spectrum further benefit because they can be set up by grass-roots organizations as needed, avoiding dependence on a telecom carrier. This is particularly important for rural areas, which are less enticing to carriers due to the low density and income of potential consumers.

Intranet usage:
Provision of network access does not mean to have Internet access. In lots of developing areas, basic local communication infrastructure is missing. With the help of wireless network within a city enables a broad range of applications including telephony, fundamental services and health care etc. For example, deployment of an intranet network in South India between hospitals and rural vision centers that supports rural telemedicine (RPatra, 2006). Regardless of such a phenomenal, few research efforts are concerned towards analyzing how to build such networks for growth wireless networks in developing regions. A primary distinguishing feature is density of users between urban environments in developed countries with a majority of regions in the developing world (with the exception of highly populated cities). We argue that previous work on wireless mesh networks (S.Biswas, 2003) is best suited for urban environments with high user densities. But, at lower user densities, the type of wireless network best suited to provide coverage is significantly different from the mesh networking model; such a network would consist of nodes with directional/sector antennas and point-to-point wireless links. Hence, the research challenges that arise in such an environment also significantly differ from those of mesh networks.

In this paper, we study an end-to-end systems perspective at the overall challenge: how does large-scale long-distance wireless network that can provide predictable coverage and good end- to- end performance in the face of competing traffic (from other sources using the same network) and over potentially highly lossy environments (induced by multi-path and external interference) and systematic link/node failures? Answering this question involves addressing research challenges at various layers of the networking stack. In this paper, we elaborate on these challenges and describe our initial efforts towards addressing some of these challenges.

Wireless in Rural Areas and its benefit:-

Many rural areas are still without wireless access, despite the advantages of wireless alternatives in rural India. Reason behind this is sometimes due to limitations of technology. In rural areas, residences are tens miles apart, it makes complicated to propagate signal to each home near the base station. Investors, like hinders company need to

supply quality Internet service even if there is company exists to make this possible easily. As from the illustration of Figure 1 (Kalpana,2011), it is very easy and profitable to supply services in dense area where so many packed cities are closed together as compare to spread-out farmers who would love to have the service like others enjoy. But, many companies are there who recognize the technology for need of rural India and seek to fill them.

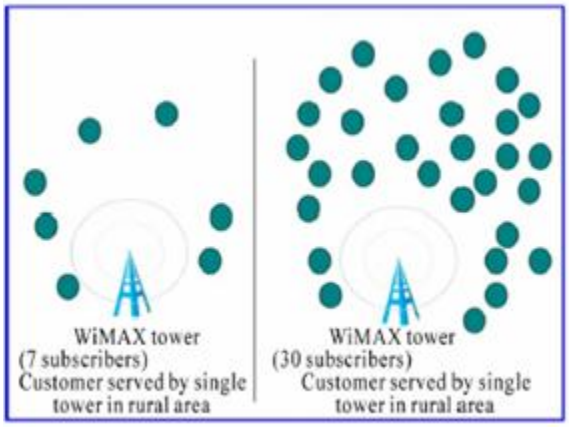

Figure 1: Comparison of services in high & low dense areas

A wireless technology in India is progressively embraced. India's telecommunication is second largest world based on networks. Mobile phones based on different wireless technologies have revolutionized telecommunication in India. While the growth of fixed-line subscribers has slowed over the earlier period, cellular usage has go sky-high, nearly doubling-up in 2003 and mounting by 159 percent thus far in 2004, with 1.4 million latest subscribers added every month. However these technologies have not been satisfactorily apply to bring the broadband data connectivity to households in rural area because of high cost and complexity issues. Yet, India needs a way to offer extensive Internet access. Through widespread wireless broadband facilities, the Indian information technology (IT) trade would grow ahead of cities reaching out to the rural populace. Students in rural areas could video conference with educators across the country, and activity programs could be telecast to remote and otherwise unreached areas together with Internet telephony services, using technologies like Voiceover Internet Protocol (VoIP). Improved communication could get remote villages into the mainstream world economy. Data access could speed rural productivity and the faster communication between producers and suppliers would fuel larger demand for Indian products.

The utility of access to telephones and the Internet in rural areas cannot be over-emphasized. By bridging distances, telephony and the internet, which fall below a wider category referred to as Information and Communication Technologies (ICTs), allow people living in remote areas unprecedented access to resources and opportunities. Online services in the areas of health, education and e-Government significantly impact the quality of life in rural areas. In the health arena, remote diagnostics will prove extraordinary helpful where medical facilities are poor or absent. In the field of education, distance learning can make supplement to domestically available school and college education, or to provide certification from well-known tutorial establishment placed in cities. These can enhance the skills and employability of the rural residents. E-Government services make available an opportunity for the rural populations to interface easily with governing body and access vital government documents without need of physically travel to distant locations.

Agriculture and veterinary services can conjointly be provided through online consultation with consultants in the cities. In agriculture, the provision of online information about price can be terribly helpful in serving to farmers decide wherever sell their produce. Several future services are also possible such as in the area of Options and Futures, which would benefit farmers by mitigating price and market risks. The internet also act as a medium to outsource work and provide training, thereby improving the workforce in rural areas and curb the trend of rural-urban migration. E-commerce is also an important path through which a wider range of products and services can achieve the rural population.

In a larger sense, governments across the world and international organizations like the international organization are also starting to recognize the potent role that ICTs will play in transfer concerning equitable socio-economic

development and "bridging the digital divide". By giving people of all strata of society the ability to choose their own course of action based on direct access to information relating to resources and opportunities, ICTs create management. It is only the wealthier urban category in developing countries that enjoys this today, and the asymmetry of knowledge access ends up in a kind of intellectual imperialism, which creates a deeply dualistic society. Empowerment of rural communities thus, through providing access to information, is the essence of democratic development, and providing telephony and internet services are initial step.

The challenges in rural areas:-

Despite the potential profit that ICT can bring to rural areas, there are certain unique challenges (Sangamitra 2007) in providing connectivity to these regions in a manner that is financially sustainable.

Technologies for rural connectivity:-

The challenges from a technology point of view are numerous. The systems that provide connectivity need to be comparatively cheap if they are to be commercially deployed, given the lower incomes in rural areas compared to urban areas. Most households have incomes less than Rs. 3000 per month (Rs. 600 per capita per month). As a result the spread of telephones in rural areas is barely 3 telephones per km^2, despite a higher population density compared to other components of the world. Another challenge is that the systems must be sufficiently strong in order to face up to the harsher physical environments that always characterize rural areas. They must even be capable of functioning without certain basic supporting infrastructure like regular power supply, for example.

Fortunately, India has certain technology advantages with regard to providing rural connectivity. Over the past 15 years, the Department of Telecommunications, the Government of India and Bharat Sanchar Nigam Limited (BSNL), the state-owned incumbent, have made noteworthy contributions toward connecting rural India, by laying fibers to almost all taluka (county) headquarters and towns. Today, many of the non public Telecom Operators (Reliance, Tata, Bharati) and organizations such as Railtel have also laid fibers to attach these towns. Almost 85% of Indian villages are settled within a 15-20 km radius of taluka towns and so a wireless system with a radius of coverage of about 20 km deployed at these towns would be able to connect a majority of the villages in the country. A wireless-in-local-loop system, corDECT, is one of the foremost cost-effective solutions during this regard, developed by the TeNeT Group at IIT-Madras in India, in collaboration with a Chennai-based company, Midas Communication Technologies Private Ltd. Its features are also ideally suited to rural use.

With a radio exchange and base station located at a taluka town, corDECT enables simultaneous telephone and internet connectivity in villages at interval of 25 km radius using a fixed wireless LOS (line of sight) system and relay base stations. While the original corDECT provided connectivity at 35/70 kbps, the enhanced broadband corDECT provides connectivity at 256 kbps. A 1000-line radio exchange and base station functions at an ambient temperature of even 55 ºC without air conditioning, and has a total power requirement of only about 1 kW, which can simply be provided by a small diesel or petrol generator. CorDECT also comes with range extenders that extend the range of its base stations.

The total deployed cost as well as subscriber unit is under Rs. 10,000 per line and the start-up cost for the system, at which the initial subscriber can be connected, is Rs. 1 million. In India, infrastructure for over 2.5 million corDECT lines has been deployed by all major telecommunication service operators. India's major Telco, BSNL, has reached nearly half million homes with corDECT. The product has also been deployed with success in ten other countries such as Sri-Lanka, Bangladesh, Brazil, Tunisia, Iran, Togo, and the Democratic Republic of Congo. Deployments are being planned in several CIS countries and other nations of Eastern Europe.

With the availability of fiber network and significant strides in technological innovation, providing rural connectivity is a reality these days. However, in order for it to be provided on an oversized scale, such technology must be deployed using an appropriate and acceptable business model.

Business models for rural connectivity:-

An inventive business model is needed to bring internet services to rural areas. Commercial delivery is crucial for the long run, while funded models drain monetary resources and are neither ascendible nor properly. However, since the urban market is now well managed and profits can be create among an inexpensive amount of time, there is little incentive for businesses to focus efforts within the rural market. The latter has not been explored and therefore poses larger effort and risk. Therefore an organization dedicated to providing rural connectivity alone is needed, which

would be willing to invest in understanding the market thoroughly. A private company, n-Logue Communications Pvt. Ltd. (Sangamitra 2007) was formed in order to meet this need. The company was incubated by the Telecommunications and Computer Networks (TeNeT) Group at the Indian Institute of Technology, Madras with a mission "to significantly enhance the quality of life of every rural Indian" by setting up a network of wirelessly connected internet kiosks in villages throughout India. The n-Logue uses for profit business model and the corDECT technology forms the backbone of its network.

The n-Logue's three-tier franchise business model consists of the company at the highest, Local Services suppliers (LSPs) in the middle and the Kiosk Owners (KOs) in the lowest tier. Inspired by the STD-PCO and Cable TV examples, the model involves creating native entrepreneurs who will own the kiosks and drive the business at the village-level. The role of the LSP in this model is to set-up the technology infrastructure in a very particular region together with n-Logue, in order to produce last-mile connectivity and also to provide support to the kiosk operators among the area.

The company helps the KO set-up a kiosk by providing her or him with the mandatory hardware, which consists of a Multimedia PC, a UPS with battery, a digital camera, printer, and the corDECT wallset with related accessories. The total cost of this instrumentation and a promoting kit, local language software, training and an internet connection for the first six months of operation is approximately Rs. 50,000. However, to start the business, the KO need only come up with Rs.10, 000 as n-Logue helps the KO secure loans through banks for the remaining quantity.

Once the kiosk is in operation, the KO can access a host of services developed by n-Logue. These include computer education, adult literacy programs, agriculture-related services, health services and e-Government services. Many of these services make use of iSee, low bandwidth videoconferencing software that enables villagers to communicate with various experts remotely. Other online services include entertainment (games, music and movies) and astrology. In addition, the KO could provide any range of services that he or she develops independently, or with other partners, at the kiosk.

Appropriate and affordable ICT-based services:-

The value of ICT infrastructure comes from its ability to deliver services that are valuable to the local population. If priced appropriately, such ICT-based services can discover a large rural market. Significant potential exists in many areas –health, education, e-Government, outsourcing, agriculture and financial services – however services in each of these areas have met with a varying degree of success. In this section each domain has been ranked on a scale of 1 to 5 on the premise of its success among the n-Logue kiosk network. The ranks have been accorded on the premise of the demonstrated earnings to the kiosk operator to this point and feedback from customers.

In the area of education, a good quantity has been understood concerning the computer education services for the rural market, and these have been upgraded over time and give a steady revenue stream to the kiosk. Other educational services include an 'Online Tutorial' serving to students of high-school pass their 10th and 12th grade examinations. Wherever this facility has been launched, the impact on students' performance has been extremely impressive, with high pass percentages and good scores on qualifying examinations. Spoken English is another concern that is popular among women specially. Recent services have been developed in the fields of Computer Graphics, Typing, etc. and also prove promising results. Overall services in the area of education are assigned a ranking of 3+ on a scale of 5 and these are believed to have a very large potential in rural areas.

In the health arena, the telemedicine kit – which permits patients to transmit important parameters such as blood pressure, pulse rate, temperature and ECG online to doctors located elsewhere – has been piloted in a few areas however has shown solely limited results, despite the fact that many villages do not have access to a well-qualified doctors or hospital facilities. They do not have self-belief in system of remote consultation and diagnosis. Video-conferencing has been successful in the area of eye-care to some extent, where patients are afterward referred to a city hospital for a detailed check-up if needed. Overall this service has been accorded a rank of 2+.

In agriculture, n-Logue partners with experts at the Tamil Nadu Agricultural College and Research Institute to provide recommendation on farming strategies and solutions to crop and animal diseases, via videoconferencing. Through the kiosk, farmers can additionally access various agricultural portals to seek out weather forecasting, real time crop prices, and improved farming techniques. Other agricultural services offered through the kiosks are the sales of tractors and spare parts, in partnership with farm equipment producing firms. In areas where livestock

rearing is common, kiosks provide online veterinary counsel. Potential future agricultural services planned by the company include soil testing facility at the kiosk, online farming "schools", an early warning system for disease outbreaks, and long-term predictions on crop costs, demand, and rainfall. Given the size of the agricultural sector in the country, the level of outreach in these services has been extremely limited and much more remains to be done. Therefore as per the current status it has been given a rank of 2–.

In the area of e-Government, kiosks provide access to government portals that contain online forms and applications for birth and death certificates, etc. In the southern state of Karnataka, the kiosk network has partnered with the government's Bhoomi database, allowing access to land records. The n-Logue has also organized videoconferencing sessions between village kiosks and local government officials. By providing a means to bypass government bureaucracy, such services have a huge demand but have not seen commensurate results. Proper implementation along with the government is the key to making this a success. This service is ranked 1+.

Considerable efforts are being created to outsource work to rural areas in the IT-enabled services field and early results are promising. This service is ranked 2+ today. Similarly, the use of ICT to train rural women in the area in crafts and outsource work from urban areas has a tremendous potential and based on current achievements this service is ranked 2+.

Overall, the most popular services in the kiosks today are internet browsing and email, computer games and education. Students also come to the kiosk to check exam results and this enormous revenue earner at many kiosks, although seasonal. Desktop Publishing and Photography are additionally among the popular services. E-government, astrology and matrimonial services are much less used and in the areas of online trading and financial services (banking and credit) very little have been done so far. The low cost rural ATM shows considerable promise however is nevertheless to be deployed and used on a large-scale.

While the issues of the past pertained to technology and devising an appropriate business model, today much has been learnt in both of these areas. The main challenge today is to develop services that are productive and which can generate healthy revenues for the kiosk owner, thereby making the business sustainable. In terms of the ranking used in this section, the aim is for all of the services to reach 4+.

Conclusion:-

The involvement of rural India to the economic growth is very immense. Almost 70% population is living in the rural division of India in about 638,365 villages. By Economic Survey of India (Sangamitra 2007), in year 2013-14; agriculture industry contributed 15.2% to the country's GDP. The agriculture sector grew by 4.7% in the year 2013-14 and it contributes for 54.6% of employment in the country. Nearly 75% of new factories in the last decade were built in rural areas of India. The significance of broadband for growing efficiency and productivity of each producing and agriculture sector cannot be overdone. It can create the rural market additionally accessible to numerous players and might facilitate in bridging the gap between rural and urban digital world. The services could be in native languages to succeed in India with none of any cultural, geographical or linguistic obstacle. The new technologies are not far from the rural India. Technologies like machine-to-machine (M2M) are being used in several agricultural VAS applications like Nano Ganesh. John Deere has using M2M in their tractors to keep record of the performance and fuel consumption. IKSL's Experts Farmers' Helpline provides information to farmers on weather forecast, market prices, farming guidelines, etc. There are several eminent examples of mobile banking services such as m-Pesa, m-Kesho is provided in rural areas. Confederation of NGOs of Rural India (CNRI) launched a theme to introduce web libraries in rural households. Broadband can be associated with e-Commerce, telemedicine, e-Learning and other services mentioned above and take away the supply-demand gap in the rural areas that lack basic infrastructure.

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