Rural Internet Connectivity in Village Insight from the Case Study

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***Abstract*—Rural connectivity is widely research topic for several years. In India, around 70% of the population have poor or no connectivity to access digital services. Different solutions are being tested and trialled around the world, especially in India. They key driving factor for reducing digital divide is exploring different solutions both technologically and economically to lower the cost for the network deployments and improving service adoption rate. In this case, we aim to study the rural connectivity use-cases, state of art projects and initiatives, challenges and technologies to digital connectivity in rural parts of Village. The strengths and weakness of different technologies which are being tested for rural connectivity is analysed. We also explore the rural use-case of 6G communication system which would be suitable for rural Indian scenario.**

***Index Terms*—Digital divide, internet connectivity, mobile technologies, shared spectrum, use-cases, Rural Network Development, Village Connectivity, Network Optimization, Community Networks, Rural Broadband Access, Digital Divide, Network Infrastructure, Telecommunications in Rural Areas, Village Internet Access, Rural ICT (Information and Communication Technology**

I. INTRODUCTION

In villages, network problems can be annoying and difficult to fix. Villagers may encounter inadequate mobile network access for a number of reasons, such as obstructions from other radio frequency transmissions, physical hurdles, and infrastructure limitations. In addition, network congestion, power outages, and inclement weather can all exacerbate network challenges in rural regions.

Approximately 40% of the world's population lives in rural areas, where problems include poor connectivity, limited internet access, and inadequate network equipment. Telemedicine, online learning, e-commerce, and other essential services are hindered by these issues. Furthermore, villagers' personal information and financial transactions are compromised by cyber threats due to insufficient network protection.

The definition of smart villages states that rural areas and communities which build on their existing strengths and assets as well as on developing new opportunities where traditional and new networks and services are enhanced using digital, telecommunication technologies, innovations and the better use of knowledge.

The presented research paper answers research questions including:

- The current state of the villages in the aspect of technological implementation.
- Scope of technological interventions in villages for different applications.
- The significant impact of the digitalization of villages is presented in detail.
- The discussion and possibilities of digitalized villages with distinct digital technology are presented with applications.
- A case study is conducted in Maheru Village, Punjab is analyzed to identify and understand key village infrastructure issues.
- The main recommendations were given in the article, where it provided that sustainable energy sources and broad integration of communication networks are necessary to achieve digitization.

II. LITERATURE REVIEW

The word "village" has long conjured up images of a location that is remote from civilization and devoid of basic amenities. In order to see significant growth, we must acknowledge that village developments and improvements are just as vital and significant as those of urban centres. Five major levels can be used to classify the development of village stages: excluded

village, linked village, committed village, experienced village, and actor village.

A. Rural Innovation: Technologies for a smart village

Technologies integration transforms the traditional infrastructure of any field in the village on a digital network. It assists to bring the village communities on the global network where it leads to enhancement of livelihood of villagers in terms of education, health care, farming, small-medium enterprises (SME's), etc. illustrates the applications of technology integration in the village communities.

B. Recommendations:

Smart village aims to achieve the goal of sustainability and smart. To achieve the goal of the smart village, every field/ service needs to be digitalized. Digitalization is only possible when reliable and robust communication and network infrastructure are installed in the village environment.

C. Digital village smart ecosystem:

A Digital Village Smart Ecosystem is an integrated network of digital technologies, infrastructure, and services designed to enhance the quality of life, economic opportunities, and sustainability of rural communities.

III. METHODOLOGY

The present study is analytical in nature. The data for the study has been collected from various published sources including the reports, art. In Dabhon village in Dahanu taluk, internet connectivity has been very low for many years, causing obstacles in doing online business, college lectures or online work and the many more critical network issues. Social network analysis, also called network analysis and structural analysis, is a method of analysing networks of actors linked by social relations. It should be pointed out, however, that social analysis itself is seen as a collection of individuals, actors, institutions, or units - so-called nodes, linked to each other by a system of relationships Network analysis is a research method aimed at identifying arrangements and patterns of relationships in a network based on the ways in which nodes are connected. It is used to describe and explore patterns of interaction occurring in networks and to identify these patterns for individual network members.

A. Rural connectivity use-cases

The internet provides immense potential for the development of rural communities. The prominent and emerging use-cases for digital connectivity in rural Village.

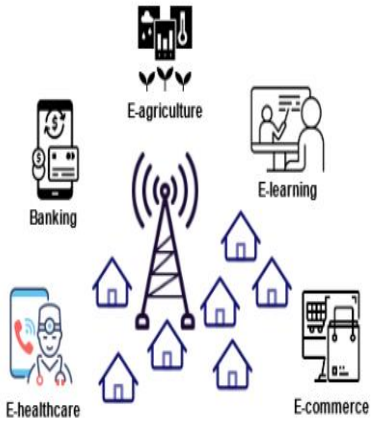


Fig. 1. Rural connectivity use cases

B. Education:

Connecting rural communities help enable distance education in remote parts of the city, including vocation training classes to build skill-sets such as tailoring and weaving. Digitizing and recording teaching material for students with visual impairments is making the education sector even more inclusive. And the given challenges of education in the village area to found it.

- ✓ Limited infrastructure
- ✓ Geographical barriers
- ✓ High cost of internet services
- ✓ Low digital literacy

C. Healthcare:

Monitoring health and remotely accessing healthcare services by rural or isolated communities can be achieved through reliant connectivity. Telehealth includes long-distance clinical health care, patient and professional health-related education, public health, and health administration. It has been used by emergency medical personnel and for consultation during natural disasters and in military battle situations.

D. Agriculture:

The main occupation of rural communities in Village is agriculture. Over the years, a declining employment size of the agricultural sector has been observed. The internet can improve agricultural productivity such as for sharing essential information on sowing, crop protection, improving soil fertility and weather.

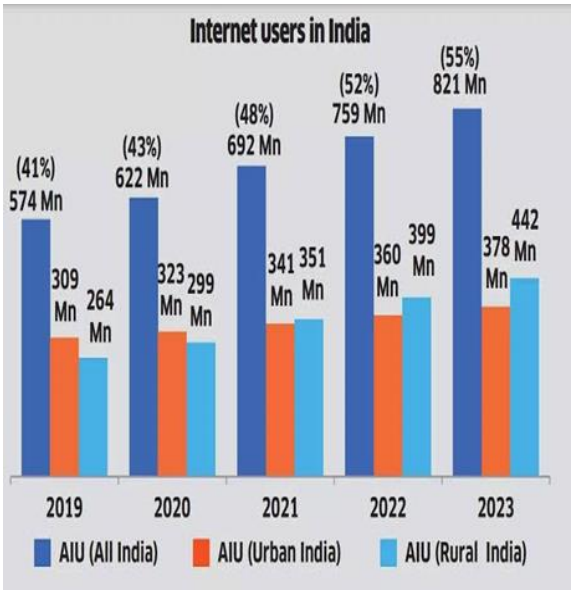
These all facilities want to be an internet connectivity is best that are not available to be village area.

E. E-governance

Various government services related to jobs, education, wellness, pension, justices are available on the National Government Services Portal. Further other pandemic based essential services such as information on the vaccination centre are available on this platform. Connectivity is critical to rural sector to easily avail these e-services.

IV. RESULTS & ANALYSIS

The information given in the table below is obtained from various published articles and similarly shows the Internet in Rural areas and Internet in Urban areas.India, with its vast geography and diverse topography, faces a significant challenge in ensuring equitable internet access across all its regions. While the country has made tremendous strides in enhancing digital connectivity, a substantial number of villages still remain disconnected from the internet's vast resources. This digital divide is more pronounced in certain states, particularly in remote and rural areas.



V. CONCLUSION

This research paper provides a on rural connectivity challenges and possible solutions in India. The problem of providing high-speed connectivity to more than 70% of the population of India is serious and needs to be addressed. Thus, in this paper, the use-cases, various government initiatives and projects, challenges, and technologies required for rural connectivity in the rural Indian scenario are explored, listed, and analyzed. The typical solutions and their strengths as well as weaknesses are listed. The lessons learned from the survey are that no single solution is suitable for all villages. The challenges, initiatives, and technologies need to be considered and weighted according to their suitability to find a solution to cater to the use-cases and demand of the rural areas.

It is in agriculture, where the maximum difference needs to be made. More than 65% of the population depends on agriculture for their livelihoods. Contribution of agriculture to the country's GDP has come down from around 23% in the early 90's to 18.5% in 2006. The CAGR of the sector for the years 2001 to 2006 is as low as 3%h. Indian newspapers have been reporting nearly every day suicides committed by farmers when they lose everything in agriculture and cannot repay their debts. In order to help improve this situation, Experts and companies are trying to work a solution using the ICTs as a facilitator for development of this sector.

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