Analysis and Identification of Potential Cell Tower Sites using GIS

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ABSTRACT

GIS can vastly influence the rural development, providing huge amount of information in accurate and timely manner. In this paper, the factors influencing the establishment of new Cell towers in those areas which has been out of reach, has been elaborated. Identification of BlackSpots, the areas where mobile strength is non-existent, are done by data collection. For selection of a potential site, the most important requirement for a property is that it must be inside a "search ring".

INTRODUCTION:

A geographic information system (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns of geographical characteristics of Earth. With GIS technology, people can compare the locations of different things in order to discover how they relate to each other. For example, using GIS, the same map could include sites that produce pollution, such as gas stations, and sites that are sensitive to pollution, such as wetlands. Such a map would help people determine which wetlands are most at risk. Some basic advantages of GIS are visualize spatial information, power to create maps with images shown, can be used for a vast range of tasks involving geography, provide solutions for problems, and model seismic activity precisely.

GIS is considerable whether there is a small business, a multinational conglomerate, a government department, or local authority, you can bank on two things: a lot of your information will be geographically referenced, and the more information you have, the harder it becomes to manage and interpret. It is a fact that up to 70% of all information in circulation possesses a common denominator: geography. In this case, GIS is important to you because it helps you make decisions based upon geographical information**.** Unlike any other type of information handling tool, GIS can understand the concept of location.

One of the major requirements for rural development is to have the accurate and timely information – information in geo-spatial forms that allows generation and use of different maps,

GIS data and applications. Information of rural areas that characterizes the social and economic environment, physical environment and rural services and amenities are critical in planning and development of rural areas.

Focus of Rural development and Planning In the rural framework, there are 4 core areas that are focus of planning and development:

- Rural Development - This focuses on development of rural manner in a holistic manner and improvement of quality of life.
- Important schemes for generation of self-employment and wage employment, provision of housing and minor irrigation assets to rural poor and Rural Roads.
- Land Resources - This focuses on assessing and managing land as a resource unit in rural areas. The need is for increasing the soil and moisture conservation and productivity of the wasteland of the degraded lands thereby increase the income of the people.
- Drinking Water and Sanitation - This focuses on providing basic drinking water and sanitation facilities in rural areas.

LITERATURE REVIEW

Dalela[1]This paper discusses a technique of generating rural radio network plan for GSM based on ASSET3G parameter tuning and identification of uncovered areas using mobile networks. The network planning has been carried out using digital clutter, terrain and vector data as input. The ASSET3G parameters have been tuned to achieve the closest matching plot between the measured and generated values of path loss. ASSET3G output along with boundary and census data is provided to MapInfo Professional to determine the tower position. The radio network plan for entire rural India has been generated. Huali [2] this paper proposes a method which is used to calculate propagation losses while transmitting in rural areas. The method extracts path profile from Digital Elevation Model, and then divides the ground points which in the path profile into shadow zone and non-shadow zone on the basis of peak points. The propagation losses of these two cases are calculated respectively. Afterward, propagation losses in all directions are calculated and the distribution map of propagation loss is generated. The study indicates that this method is able to calculate propagation losses in complex terrain areas to a certain extent, and provide decision support for station site selection and network optimization while constructing base stations. Dasgupta [3] the public health nodal offices collect the health data from different regions for further analysis. The timeliness and correctness of the collected data is important for public health management. Web based mobile applications may be helpful but it requires constant network connectivity which is often not available in rural regions. This paper proposes a geo-aware SMS or Geo SMS based framework for acquisition of data related to public health management in rural India. Martin[4] the decision to adopt smartphone applications (apps) that provide advanced communication services is complicated by the uncertainty of whether they will actually perform well in the field. Reliable operation in the field is hard to assess from laboratory demonstrations with reliable network coverage. This paper presents preliminary work toward an empirical model that predicts the number of bars in specific geographical locations using

"crowd-sourced" signal strength data. Preliminary field test data was used to illustrate a Geographical Information System (GIS)-based end-to-end process by which signal strength (number of bars) in rural areas can be predicted from available signal strength measurements on major thorough fairs. Two linear models for predicting signal strength were developed using predictor variables that are easily assessed using standard GIS software. While the results presented here fail to achieve a high degree of statistical significance, the basic feasibility of the approach is established, and the factors that contribute to success or failure of the approach are discussed. Prasad [5] Field-strength measurements were conducted in the rural eastern part of India in a moving train along the railroads, In the UHF band. This was done to identify suitable models for various rural zones of India along railroads, and to evaluate the suitability of existing models. Various models were tested with the data, and the standard deviations of the prediction errors were determined. Path-loss exponents were derived, and were found to vary between two to three in low-density scattered environments. In rocky and hilly environments, the values shot up to more than six. The study also showed that numerical electromagnetic codes can be used to predict the path loss over any ground with relatively good accuracy, as their predictions agreed with experimental results. Dalela [6] this paper proposes ITU-T fiber based technology specific mobile backhaul planning for rural India. More than 70% mobile towers of India are installed in rural areas. In order to take the advantage of growing mobile technologies to address the digital divide of rural India, it is essential to provide adequate backhaul connectivity. Fiber based technologies have merits to address this demand. Technological planning of fiber based technology requires accurate digital mapping of existing, new fiber and components on GIS. The selection of appropriate technology for Cost, Coverage, Capacity, QoS and Security aspects for rural areas are of prime concern. The present research focuses on region specific technology selection with existing infrastructure considering diversity of India. The limited budget and bandwidth requirement of rural India, suggests tree based Passive Optic Network (PON) as the suitable technology. Mohite [7] this paper discusses the development of a novel event based Rural Participatory Sensing (RuPS) framework for agricultural crop monitoring which rewards farmers based on their participation levels. In particular, we propose a novel Multi-Criteria Decision Making (MCDM) based rewarding scheme which incorporates event-centric and GIS attributes for agricultural applications. We envision that this domain-specific rewarding scheme will be suitable for the RuPS framework to motivate farmers to participate. Participants reported events related to the citrus crop for a three-month period, using the RuPS mobile application. Based on the quantity and quality of sensing data contributed we develop a ranking scheme using MCDM methods.

PROPOSED WORK

With "Digital India" just around the corner, huge changes are in progress keeping in mind the Technological Development of India. However the key to such a huge program is connecting each and every individual in the country. Connecting individuals from urban areas are not a big deal. However, connecting the rural people over the arid areas of the country are much challenging tasks. Establishing Mobile connectivity becomes very important in such cases.

To establish a particular cell tower, a telecom company faces a lot of challenges. Identification of Blackspots, the areas where mobile strength is non-existent, are done by data collected in form of request not served and complaints received from the existing customers. Surveying the particular areas or gathering the relevant information through local agencies are also important.

The first requirement for a property to be suitable for cell tower is that it must be inside a "search ring". A search ring is an area designated by a cell phone carrier that shows where they need to place a cell tower. Following Characteristics are taken into consideration for potential cell tower site:

- **Available Vacant Land**: A potential cell tower site must meet certain size requirements. They usually look for sites where there is potential to scale in future.
- **Construction Expenses**: They must weigh in the cost of construction based on the characteristics of an available property.
- **Access to the Tower**: Easy to moderate access is a must for a cell tower, so properties nearby roads are preferred.
- **Topography**: This classification decides whether the property is suitable for construction or not. Whether the ground is strong enough or if there are structures nearby that could hinder the signal.

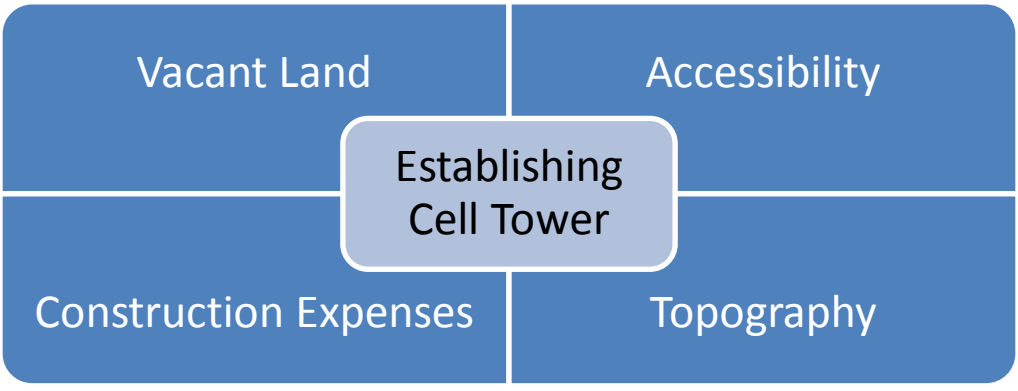

Figure-1: Identification of Potential Cell Tower Sites using GIS

These task takes numerous month to complete, let alone the time taken to build the tower itself. This time span could be reduced to a great extent using GIS or Geographic Information System. Each of the above characteristic could be efficiently done with the help of GIS. Not only we can identify the most optimum hotspot location, we can do this quick and easy.

CONCLUSION

In this paper, it has been explored that identification of sites for the establishment of cell towers requires data collection, and GIS could be used to select the best out of those search rings. The characteristics influencing the establishment of cell phone towers can be optimized successfully using GIS, not only in terms of resources invested but in terms of time too. This work can be extended to establish the optimization of the strength of mobile network so that maximum request can be served with minimum number of cell towers.

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