Mobile GIS: For Collection of Socio-Economic Data and Water Resource Management Information (Case Study: Rural Maharashtra State, India)

S.B.Thorat, S.B.Kishor, M.V. Rmana Murthy, Sudhir Jagtap & M.M.Bokare

Abstract **- In India data collection sector, especially in rural areas of Maharashtra state of India at present, suffers from decelerating data collection rate & decision making based on the data collection of rural areas. It is essential to catalyze the data collection, increase the rural information access & analysis rate, and release the timely decision making policies. Serious challenges must be addressed in order to achieve faster data collection. These include infrastructure constraints, supply chain inefficiencies and significant problems in the diffusion of and access to information. The increasing penetration of mobile networks and handsets in India, therefore, presents an opportunity to make useful information more widely available. This could help policy & decision making more efficient and overcome some of the other challenges faced by this sector. It is therefore timely to take a fresh look at the impact of mobile data collection of rural area of Maharashtra state of India on the performance of policy making in India. Field of data collection plays a pivotal role in many enterprises and government agencies deriving important decisions that ultimately affect the bottom line of the society. Many current methods and technologies are inconvenient, error-prone, and time-consuming. There is a great demand for reliable systems that quickly bridge the realities of the field to the desks of decision-makers, whether in agricultural surveys, data collection, engineering, construction, utilities, military, security, law enforcement, or in any industry with a substantial mobile field force. This paper proposes the idea of using Mobile GIS which is a panacea to all the above raised issues. Mobile GIS helps to gather and transfer the intended data quickly towards the masses.**

Index Terms - GIS, DB, CARTOGRAPHY, GEO-DATA, ZP

I. INTRODUCTION

A Geographic Information System (GIS) is a computer assisted system for the acquisition, storage, analysis and display of geographic data.

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Some of the terms are discussed below:

- Geographic- Indicates that data items are known in terms of geographic co-ordinates.
- Information- Implies that data in GIS is being organized and processed to yield useful knowledge.
- System – Implies that a GIS is made up from several interrelated and linked components with different functions. (Bonham-Carter-1994)

Geographic data: - This represents real world phenomenon in terms of:

- Their shape and position (with reference to a known co-ordinate system)
- Their characteristic attributes - e.g. Soil type, Cost, Population etc
- Their special interrelationships (Topology) with each other (describes their linking) [Burrough & McDonnell - 1998]. This information is organized in Layers/ themes

II. SYSTEMS OF GIS

The systems of GIS are Cartographic Display System, Map Digitizing System, Database Management System, Geographic Analysis System, Image Processing System, Statistical Analysis System and Decision Supports System. (See Fig.1)

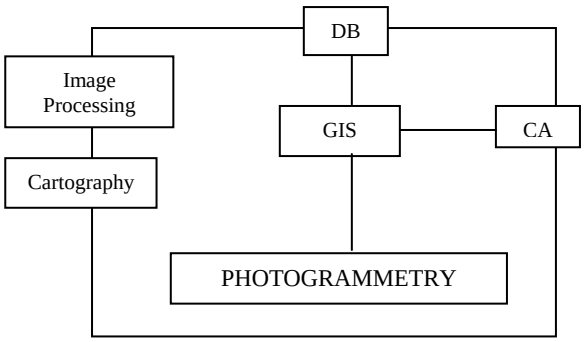

Fig 1 Systems of GIS

III. COMPONENT OF GIS

It has three important components: -

- Computer Hardware – Computer [Minimum P-4 1.5GHz based, [40 G.B. H.D., 128 MB.RAM, CD Drive (52x), 1.44 MB drive, Colour Monitor 14" Inbuilt-Modem, Sound Blaster and Ethernet Cards] and Digitizer/Scanner and Plotter/Printers and Dialup

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connection through phone (i.e. internet hours) for inter- computer- access.

- Set of application software modules- Application Software/Programme based on any GIS Software (e.g. ESR's- Arc View and Arc information, Intergraph (Geo-media), Auto-CAD Map, C-DAC's various software of GIS) as per need, Back-end and Front-end Software (e.g. Oracle and VB respectively), Web browser (e.g. Internet Explorer or Netscape Navigator). These modules need to be designed carefully after interaction with End-user to meet the requirements of application to be worth to be used by even a layman (i.e. it must be menu-driven and user friendly)
- Proper organizational context (Burrough and McDonnell, 1998) - This refers to the management, analysis and other aspects involved in the implementation of GIS (The needs differ based on objective).

IV. FUNCTIONAL COMPONENT OF GIS

It has five functional components:
Data Input, User Interface, Geographic Database, Display and Reporting, Transformation/Analysis

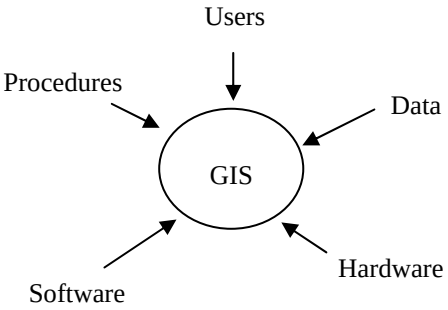

Fig 2 Main Software Compononts of a GIS

V. SETTING UP GIS

This includes intergration of attribute data with graphical data. This also requires fieldwork, verification of the data and quality control. It is set up in four stages:
Stage 1: Planning- This is prerequisite and defines data requirment- Nature of data, its sources and its forms all defined attributes, graphic inputs such as maps or technical drawings, or external files from existing systems.
Stage 2: Preperation of Applications:- To prepare the applications and man-machine interfaces according characteristics defined in privious stage and with concent to end user.
Stage 3: Data Capture:- Data is being collected from numerous sources, inputed to the system and verfied. Begins at the conclusion of the planning stage and may be carried out with application stage. To meet the criteria defined in planning stage, quality control must be carried out.
Stage 4: Implementation:- At this stage user gets acquented to accesss, to use and to manipulate the information, how to approch and how to solve the problems and to use Hardware and Software of GIS.

VI. APPLICATION OF GIS

GIS has ever great impact literally on every field that can manages and analyse earth's surface related (i.e.Spatial) distribated data. Primarily aimed to integrate the scattered data and information with ever high speed and analyses it with accuracy in different departments.
Used in: -Agriculture, Archaeology, Environment, Health, Forestry, Navigation, Marketing, Real Estate, Regional and Local Planning, Road and Railway, Site Evaluation and Costing, Social Studies, Tourism, Utilities etc.

VII. PROPOSED SYSTEM

India follows the planning through planning commession. Unfortunatley this planning is on the basis of information collected by tradtional, tedious and manual methods which are very slow. Moreover, by the time this so collected information reaches to the concerned policy-makers, this information becomes absolute. Hence, the policies derived using this data miserably fails & the most valuable efforts in terms of time, energy and money will be wasted. Hence, eventhough we are leading towards liberalize market oriented economy, the importance of current, accurate, reliable and high speed data/information is very much identified and realized.

A)Proposed Idea For Collection of Socio Economic Data and Water Resource Management Information (Case Study: Rural Maharashtra State, India)

The literature surveyed highlights the fast growth of Mobile GIS the emerging developing countries of Asia and Africa and their key role in reducing information search costs and information asymmetries.
In India data collection sector, especially in rural areas of Maharashtra state of India at present, suffers from decelerating data collection rate & decision making based on the data collection of rural areas. It is essential to catalyze the data collection, increase the rural information access & analysis rate, and release the timely decision making policies. These serious challenges must be addressed in order to achieve faster data collection. These include infrastructure constraints, supply chain inefficiencies and significant problems in the diffusion of and access to information. The increasing penetration of mobile networks and handsets in India, therefore, presents an opportunity to make useful information more widely available. This could help policy & decision making more efficient and overcome some of the challenges faced by this sector. It is therefore timely to take a fresh look at the impact of mobile data collection of rural Maharashtra state of India on the performance of policy making in India. It is important to know how field employees gather essential data across a vast array of extreme environment conditions and emergency situations ranging from construction sites to underground tunnels, in suspended harnesses, on battlefields, and beyond it. While considering this, it is vital to know which collection tool or tools would be most suitable or effective for any organization. Here are some questions to keep in mind:

- What is the total cost of ownership of the solution?
- What training or installation is required to use the solution?

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- Are there communications setup or integration issues to factor in?
- Is it functional – does it meet your system needs?
- Is it practical – does it meet the needs of your users?

The answers to these questions have important implications for mobile operators, information service providers, and policy-makers. We are sure that mobile GIS can be used in ways that contribute to fast development & growth of rural areas.

To overcome the above addressed problems we are proposing herewith, the use of Mobile GIS as a backbone with exiting human resource with very basic training of computer. The existing infrastructure of Grampanchayat (Govt Head Office for Village from rural Maharashtra), Panchyat Samities (Govt Head Office for Tahasil place from rural Maharashtra) and Zilla-parishad(Govt Head Office for District place from rural Maharashtra) and will require the computer (minimum P-4 1.5 based latest configuration) at least one at each Grampanchayat and Pachayat Samiti or as per need.

An application software is required to be designed (one time excercise) and once being designed this could be issued to various Grampanchayats and Panchayat Samities as such. The concerned staff of Grampanchayat and Panchyat Samiti need only to be able to read simple English text/identify icons (symbol) properly. Now a days, most of the software are menu-driven and userfriendly so that it is most easier to be used even by lay man or no voice user as such.

Every Grampanchayat staff is being expected to have rigorous surveys to collect the correct and reliable information of various fields/ attributes as per application and enter the same with time to time updates on concerned computers which in turn are being connected thhrough internet to the computer of other Grampanchayat.

Computers of all Grampanchayat are connected to the concern Taluka's computer at Panchayat Samiti office, so on so forth, all the Talukas' computers are further connected to the concerned District via internet connection. In this way, merely seating at Taluka office, all necessary and accurate information can be collected, analysed and presented to the District Head Office (i.e.Zilla Parishad.) for further information and effective decesion as such.

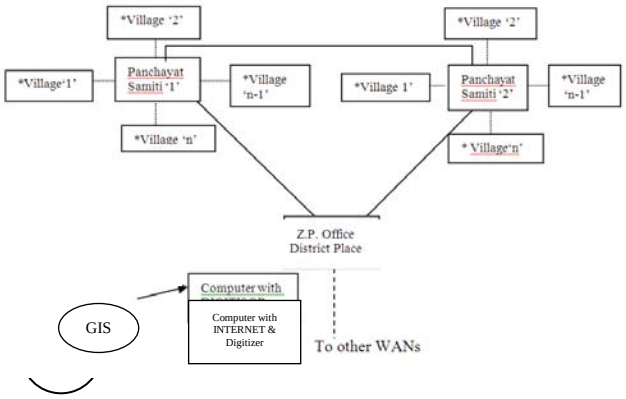

Fig 3 Proposed Conceptual Dialup Network for Fast Access of Geographical Data

B) Collecting Critical Data from the Field –

Today, the most confronted issue faced by the organizations is the lack of efficient methods of data collection and timely dissemination across distributed teams that drive critical decisions. In the field, pen and paper has been used for decades since it is a common way of gathering information and easy to carry. Construction workers for example, often refer to their use of pen and paper as "huddle and scrawl", where they gather around a paper map, collaborate, and mark it up with field notes. This tried and true method is familiar for field workers but manually transcribing field notes from paper to computer is not only costly and time consuming, but also a redundant activity that is error-prone since handwriting and sketches can be difficult to decipher. In addition, omissions may also be made if critical points are lost in pages across multiple documents.

As the demand for real-time information has increased, new data collection technologies such as rugged PCs, tablets and PDAs have entered the market. Among the difficulties with deploying these devices are that time is often required to train field workers to use them, and often there is resistance among staff towards changes in business practices. In many instances, these tools may not be convenient for the situation at hand or durable in harsh weather, In addition, the time and support costs for non-working devices tends to be significant. From a practical standpoint, PCs and tablets are heavy, have limited battery life, are hard to see in bright sun, and require the user to attend to the computer rather than the job. While PDAs are highly portable, they are hard to use because they are too small to provide the spatial perspective needed.

It's not surprising that field employees often reject these current computing technologies and naturally revert back to familiar and more convenient paper versions like notebooks, maps, charts, forms and other documents. When faced with stressful situations while on the job, it is easiest to use what they know best – pen and paper. Digital pen and paper technology has been around for more than a decade but traditional solutions were primarily one-off products that locked users into proprietary applications or offerings from systems integrators that required the acquisition of special software and had limited integration and functionality

VIII. THE FUTURE OF MOBILE GIS & FIELD FORCE DIGITISATION

GIS has come a long way with organizations being able to access and modify geographic information easier and quicker than ever before. As mobile computing becomes increasingly "the standard", and specifically as more and more industries discover how to apply the efficiencies that mobile GIS provides, there will be increasing growth in how these applications evolve to meet situation-specific needs. We are seeing major advances in GIS technologies and ESRI is at the forefront of some very promising developments, in areas such as:

- Cartography–Improving GIS desktop applications through additional cartographic mapping, analysis, and editing tools and providing user-driven usability enhancements

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- Servers – Evolving a robust server GIS platform to deliver comprehensive geographic information services through a wide variety of clients and client platforms
- Mobile GIS -Advancing mobile GIS via wireless technology to make organizations and their mobile workforce more efficient and productive.
- Geo-Web – Expanding the access of information by anyone at any time via the Internet.
- Geo-data-Management–Extending comprehensive geo-database functionality and geospatial data management capabilities

It is certainly an exciting time in the evolution of GIS. Not only we are witnessing this "rebirth of pen and paper" as it relates to mapping, we are also on the verge of other game-changing technologies that provide operational advantages for a wide spectrum of industries.

Water is a vital resource for human survival and economic development. As the populations and economies grow water demand increases while the availability of the resources remains constant. Shortages engender water use conflicts, both in terms of quantity and quality. There is considerable variation across the country in laws and institutions related to water. Project implementation ability is not uniform. Therefore, to have the uniformity in planning and project implementation ability, along-with socio-economic data, it is further proposed that the detail information of water resources, their current status, the contamination (if any), uses, capacity etc could also be shared with Environment Scientists for further analysis.

In this way the current, accurate, reliable information regarding water resource management along with socio economic data can be made available for betterment and uplifts of rural areas. The integrated management of other resources in the watershed, such as soil and vegetation, could also be included, as beneficiary participation in this data. Efforts will be directed towards supporting water resources planning, policy making and management through required development proposed by concerned eminent scientists after analyzing this so made available data via internet. As per the intensities of the problem this scheme will be an effective tool to take online decision as corrective measures whenever it will be required to do so.

The above proposed scheme is being needed to be deployed all over the country for volumenuous current and accurate geographical data collection. This helps for analysis and presentation of absolutely reliable inforamtion for further use. Hence with the advent of technology the need of hour is to combine SCADA (Supervisory Control And Data Acquisition) with GIS for its wide sprade uses via internet for the development of the rural areas.This gives us the uniform, effective, useful, accurate & reliable geo-referenced/Socio-economic-data and water resource management information collection of rural area by completely automated system.

*i)Merits***:-** This helps to have fast collection of socio economic data and water resource maangement information of rural area accurately and reliably. Hence it will serve a strong basis for policy makers and certainly will lead to the betterment of society.

*ii)Demerits***:-** Intial investment is high (but once being invested, recurring expenditure is only for the collection of data and analysing it, which could still otherwise would have been carried out manually).

IX. CONCLUSION

Pertaining to the need of high sped data collection from rural area, this proposed scheme is the best option for collection of high speed, accurate and reliable data/information with ease to ensure proper & timely use of this so collected data by the Planning Commision of India to design the better policies. This potential system will certainly be useful and beneficial for the betterment of rural areas of Maharashtra stste of India.The authors strongly endorse that better policies could only lead to proper development & growth of rural area & hence strongly recommend the proposed system in the interest of mankind. We are sure that mobile GIS can be used in ways that contribute to fast development & growth of the rural areas.

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