A CONCEPTUAL MOBILE GIS SYSTEM FOR GLOBAL EMISSION MONITORING

G.Venkateswara Rao [a], G.Veereswara Swamy [a], M.Jagannadha Rao [b], P. Premchand[c]

a. Department of Computer Science and IT, College of Engineering, GITAM
Visakhapatnam, Andhrapradesh, India. vrgurrala@yahoo.com
b..Deparment of Geology, College of Science and Technology, Andhra University
Visakhapatnam, Andhrapradesh, India. m_jrao@rediffmail.com
c. Department of Computer Science Engineering, Osmania University, Hyderabad

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ABSTRACT:

Today information systems play key role in new century, geographical information system (GIS) as a special class of information system. Now we are moving wired to wireless network, that is mobile environment shown in fig2 (any where any time and any thing computing), plays key role in this new century.

In this application mobile GIS, which will be a network environment, is proposed, which can perform monitoring of emission levels at a city level or country level or Global level. The concept will be as follows. The analog data of Automated weather monitoring devices (AWMD) will be converted into digital form where by the respective Clint device will transfer data to the server using wireless application protocol (WAP) the hardware and software system need to be integrated where by the mobile GIS components include atmospheric emission data receivers/analyzers WAP clients of GPS enabled system routers are linked to a GIS with relevant software.

In the light of Kyoto protocol speedy and accurate determination of emission levels is need of the hour. This is especially required for signatory countries of Kyoto protocol. In this context fixed mobile automated weather stations can be connected to a mobile GIS based data base on a network/ web based GIS. This will enable daily/weekly/monthly/ yearly monitoring of hazardous parameters from the atmosphere is possible.

In this paper the mobile GIS based system its principle of operation hardware and software requirements and the conceptualization are presented. This system is believed to be idealistic for the monitoring and emission quantifications pertaining to emission estimation and trading when the total system can be implemented by an International organization such as IEA with international standards (Fig.1).

INTRODUCTION:

In simple **GIS** as spatial data handling system .

GIS data can be defined as a computer system, which is used for collection, simulating, processing, searching, analyzing as describing geographic data, in brief, GIS can be treated as an integrated computer science subject.

Mobile GIS (MGIS)

The latest revolutionary development of GIS is mobile geographic information system (MGIS). In other words

MGIS can be considered as that branch of GIS which is portable and can be taken to the field. Whereby it can interact directly with the field input through the latest technologies including WAP.The important components of mobile GIS are

- GIS Server
- Mobile hardware
- Global Position System (GPS)
- WAP communication for net based GIS access

Historically the data for spatial databases come from extensive field surveys. These surveys for data collection, data plotting, map preparation, map editing were highly manual, time consuming and error prone. Once the data are collected it will be taken to the office where field maps are deciphered and manually entered into in to GIS database. Naturally the resulted spatial database can not be that accurate and resulting conclusions or discussions can not be authentic.

Recent developments in hardware and software technologies especially in mobile methods of computing also revolutionized the concept of the GIS. The element of the mobility in data inputting devices resulted a great boon to the traditional GIS system. This almost eliminated the manual methods of data collection and data inputting. Instead the portable device with WAP enabled, the user not only to inputting the data but also to retrieve information from the servers into his hand – held devices right into the field.

Mobile GIS Application Verses Wireless GIS Application

Mobile GIS and Wireless GIS are very similar and can be called as Wireless web – GIS. In this mobile communication area , GIS network were usually divided into two types according to the wireless connection technology. One is based on the cellular Infrastructure connection technique, which is also used for Mobile GIS; the other is based on the wireless LAN techniques. Wireless network is a network , which is built , in a mobile environment , or the environment -combined wireless with wired . It is quiet convenient for data transferring network.

The common components are

- The Client
- The server
- The network

The main differences between these two are in client devices and server software. In the purely mobile GIS application users can interact with GIS data and maps on the web. This application mainly serve the public and can be considered as business to customer service(B 2 C).The Wireless GIS application is also similar but the user need to have privilege – permission to a non GIS data base and also should own GIS software for accessing. The database and for other manipulations. These applications can either B 2 C or B 2 B.

Drawbacks of Wireless Web GIS Application

Main limitations of this application are perhaps related to the limitations in web devices like low bandwidth and low reliability. The problem of small screen and less resolution may be a big obstacle, which may result a non user-friendly interface. Similarly the limitations of non-support of vector data format by the mobile web browser and plugins need to be eliminated. However the recent development in the hardware and software technology will be able to eliminate these problems.

Automated Weather Monitoring Devices (AWMD):

These devices will be having capability of continuous collection of air samples from a given area and the based on the available sensors they can be able to determine the concentration of emissions such as CO_2, CO, NO_2, SO_2 etc. The chip level programming can be developed in these devices so that the data from these sensors can be transformed to devices with Wireless Application Protocol (WAP). The hardware and software system related to this

application already exist with International standards and can be adapted to this application easily.

WAP

In recent times WAP has become the magic word in software applications. The WAP specification is mainly XML (Extended Markup Language) called WML (Wireless Markup Language) which is capable of issuing requests and obtain required output. In the present application the spatial data will be based on spatial entity and hence the WAP should support the Wireless bitmap files. Fortunately WAP have reached such a stage, now it has the enough capability to handle such files. It is now a reality where by it is possible to receive and send spatial data through WAP devices. The data from the AWMD s will becomes an attribute data and transferred to WAP with GPS where by it will be transformed to respective Geographic entity of a map and will be updated in the server.

Small, hand – held client devices:

Recent advances in hardware design resulted the development of highly portable and small devices, which are highly suitable for mobile applications. These devices are small but capable of handling the Geographic applications with power sources like battery packs etc. The current situation is characterized by great diversity with higher end systems offering a quarter VGA screen (320 by 240 pixels), 8-bit color (64 colors), 32 MB of RAM and a 200 MHz or more processor. The choice of operating systems includes Windows CE, Palm OS, EPOC, JavaOS and Linux. Some examples of device for the present application include.

- Pocket PC running Windows CE
- Palm PDA running Palm OS
- Smart phone running EPOC
- Pager with proprietary OS

To be useful as mobile geographic clients these devices must be geographically aware, that is, it must be possible to locate the device quickly and reasonably accurately. Several alternatives are currently available for fixing the position of devices of this type

Network-based

- Cell Global Identity: Cellular telephone systems divide geography into base station coverage areas typically of several kilometers in size, although in urban areas they can be as small as 10m. Only the finest resolution of data is of use to mobile geographic service users.
- Uplink Time of Arrival. U-TOA measures the time it takes for signals to travel from a handset. This system supports existing as well as new equipment, but is expensive to implement because of the high cost of upgrades to all base stations. Accuracies are around 100m.

Handset-based

Locating one self in the field is essential component of surveys based on mobile GIS. In earlier times the field investigations used to locate himself by using clinometer compass and taking the reading from standard reference points. But this method is inaccurate and with number of limitations. The recent advancements in the development of portable Global Positioning Systems resulted the establishing the location with very high accuracy (< 1 mt.).

- GPS. The Global Positioning System offers the highest locational data quality. Since the removal of selective availability accuracies of better than 10 m are possible. However, there are some limitations in the use of GPS, especially the requirement for line of sight (especially a problem in urban ‘canyons’), added cost, and the time it takes to obtain a signal. Some systems may be complemented by additional GPS receivers located at fixed

positions. This improves location calculation from 20-45 seconds to 1-8seconds.

- Enhanced Observed Time Difference. E-OTD triangulates data received from base stations. This requires that the location of base stations is accurately known and that data signals are synchronized. The accuracy of this method is estimated to be around 125m.

Geographic application server

The server is most important part of the present application and should be capable of providing wide ranging applications. The recent advancements enabled the development of servers with amazing capabilities, these include.

- Rich functionality: The services like high quality mapping, geographic and attribute quarries data downloading, geocoding, routing and report generation must be available.
- Good performance: Performance is critical for applications servers of this type because they must be able to process many requests simultaneously and potentially millions of requests per day.
- Scalability: This includes the ability to deal simultaneously with both very large data sets and very large number of application requests.
- Reliability: The server should be robust and reliable since they have to work round the year. Hence the standard hardware, GIS and DBMS software should be selected.
- The designers should ensure the software and hardware systems are of International standards and have compatibility with networks around the Globe and also with futuristic systems and applications.

Geographic database:

The final component is a geographic database containing the content that will be made available via the Geographic services in the application server. Data management and high throughput for large databases is enabled by the use of commercial of the shelf relational database management systems such as DB2, Informix, Oracle or SQL Server. The same software can be used to store and manage both the geographic and associated attribute data.

The expected outcome:

The servers can handle the continuous data input from different clients of area of operation and the database will automatically updated. The users will be having privilege to access the data and can manipulate into updated maps, reports and other graphics. The spatial database system can have all these options and further can be integrated with other softwares whereby export of data to other network is possible. The privilege of users can be limited and these are dependent upon the security options, which can be decided by all the countries involved in this system.

Conclusion

A mobile geographic service is a fast growing field of GIS. Although there is much hype associated with the technology, it is clear that even today technology is finding real business benefits in using geographic information in a mobile context. An innovative application of mobile GIS is presented to routing; to data collection there are many success stories.

This system is better used to have a potential network-based emission monitoring with international standards so that the international environment agreement like Kyoto protocol etc., can be implemented in a scientific manner. Since the standards of hardware, software in the network are uniform and controlled at one place there will not be

any issue of confrontation in deciding the levels of emission for trading and other applications.

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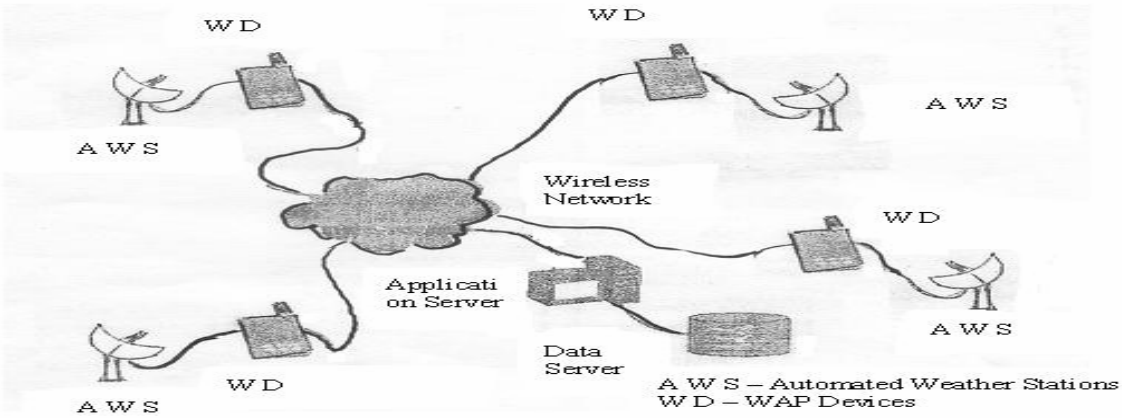

Fig: 1. Schematic diagram showing the proposed System

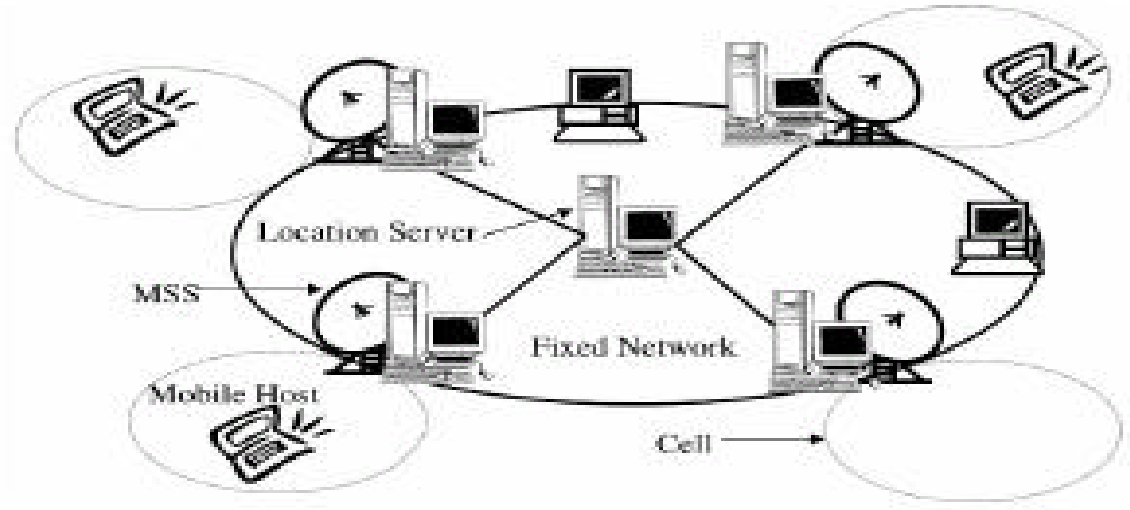

Fig 2: Schematic diagram of Mobile Environment