



## WITFOR 2005 – Building the Infrastructure

### Implementable project – GramPatra

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#### Introduction

**GramPatra** is a product of Media Lab Asia for delivering value added digital services at places which do not have online internet connectivity. Digital data as letters, audio, pictures, applications, E-Governance applications such as issue of birth and death certificates, land Records, consultation with doctors / agricultural officers on health, crops diseases and other farming related information, astrology, complaint registration are some of the applications for which this can be used by rural people. An email interface has been developed which is the backbone of GramPatra for development of various applications appropriate for different rural areas.

GramPatra complements the present internet technologies to further widen the reach of digital revolution. Presently there is poor internet coverage in India and many other countries of the developing and under-developed world and hence there is poor availability of appropriate digital information access and exchange. GramPatra presents an intermediate solution for digital information access and exchange before online internet becomes available in specific geographical locations. GramPatra can be deployed quickly as no tall towers and transmissions cables etc. are required. GramPatra is a step in meeting the Universal Service Obligation for digital information access.

#### Components of GramPatra

The **GramPatra** technology is based on store and forward methodology. The main elements of this technology are:

- ◆ **Mobile Server**
- ◆ **Kiosks**
- ◆ **Gateway**

Digital data transfer between any two of these systems happens through high bandwidth wireless IEEE 802.11X based methods. The present system is being powered with 802.11b technology with a possible bandwidth of 11mbps. The system will also work with other more advanced and higher bandwidth technologies like 802.11g with a bandwidth of 54 mbps.

#### *Mobile Server*

##### **Hardware Requirements**

- ◆ .net 4521 Soekris Box
- ◆ 512 MB Compact Flash Card
- ◆ Wireless LAN PC Card (802.11b) with MMCX/MCX connector
- ◆ 9 dBi Omni Antenna, 2.4 GHz with mounting hardware



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- ◆ 1 watt Amplifier (2.4-2.45 GHz)
- ◆ LMR/WBC 100 Cable

### Software Requirements

- ◆ Operating System – Debian Linux (v 2.4.16 )
- ◆ Qmail Mail Transfer Agent

Mobile Server is a compact, low-power, low-cost, communication device based on a 133 MHz 486 class processor. It has been optimized for use as wireless router using PCCard wireless adapters. The RF-Signals are boosted (if required) through amplifier (typically 1 watt) and use an omni directional antenna (typically 8.5dBi) to extend the range further. It requires a 12 Volt D.C. supply for the operation. Mobile server can be fixed in any vehicle which has a 12 Volt D.C. battery. The Soekris Box net4521 of Soekris Engineering is used as the basic platform for the Mobile Server. This is designed to withstand high temperature (0-60 ° C) and dusty environment conditions. This device can support up to 4GB Micro drive.



### ***Mobile Server fitted on Bus***

The Mobile Server uses a 512 MB Compact Flash card for storage. A Debian distribution of Linux is installed on the Compact Flash Card and Qmail is installed on it. Qmail is used as mail transfer agent to transfer/receive mails to/from Kiosks and Gateway.

### ***Kiosks***

#### **Hardware Requirements**

- ◆ Desktop Computer (min. PIII 800 MHz)
- ◆ 802.11b Wireless LAN PCI Card (with a provision for pigtail cable)



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- ◆ 18 dBi Directional/Omni Antenna, 2.4 GHz with mounting hardware
- ◆ LMR/WBC 100 Cable
- ◆ Printer (if required)
- ◆ UPS (if stable mains power is not available)

### Software Requirements

- ◆ Operating System – Microsoft Windows XP
- ◆ Java Runtime Environment 5.0
- ◆ Tomcat Apache Web Server
- ◆ James Mail Server
- ◆ GramPatra Kiosk Software

Kiosks are the service nodes for the GramPatra System. The wireless services are provided through the Kiosks. A kiosk basically consists of 802.11b wireless equipped desktop computer with other accessories, which depends on the service provided. As soon as the Mobile Server, mounted on any vehicle, comes in the wireless range of kiosk, they make a wireless connection and transfer the data as emails between them. This transfer of data is made automated by the GramPatra Software at the Kiosk side as well as on the Mobile Server.

### Gateway

#### Hardware Requirements

- ◆ Desktop Computer (min. PIII 800 MHz)
- ◆ 802.11b Wireless LAN PCI Card (with a provision for pigtail cable)
- ◆ 18i dB Directional/Omni Antenna, 2.4 GHz with mounting hardware
- ◆ LMR/WBC 100 Cable
- ◆ Printer (if required)
- ◆ UPS (if stable mains is not available)
- ◆ Internet Connection with Static IP Address (if emails provision from/to internet is required)

#### Software Requirements

- ◆ Operating System – Microsoft Windows XP
- ◆ Java Runtime Environment 5.0
- ◆ Tomcat Apache Web Server
- ◆ James Mail Server
- ◆ GramPatra Gateway Software

Gateway is the window to the outside world for the GramPatra network. Gateway is an 802.11b wireless equipped Desktop computer having constant internet connection with a static public IP Address. This static IP address should have DNS entries so that emails could be accepted by other email providers. All the mails to Internet as well as all the incoming mails from Internet are routed through this machine. As soon as the Mobile



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Server, mounted on any vehicle, comes in the wireless range of Gateway; they make a wireless connection between themselves and transfer the data in the form of emails from the mobile server to the Gateway. Then these emails in turn are sent to internet by the Gateway. Also if Gateway has emails from internet for the kiosks, it transfers those emails to Mobile Server. This transfer of data is made automated by the GramPatra Software at both the Gateway side and the Mobile Server.

### **GramPatra Software**

GramPatra Software is consists of three Modules. These Modules are:-

- ◆ **GramPatra Email Interface**
- ◆ **Kiosk Email Exchange Manager**
- ◆ **Gateway Email Exchange Manager**

Kiosk requires GramPatra Email Interface and Kiosk Email Exchange Manager for its functioning while Gateway requires additional Gateway Email Exchange Manager in addition to GramPatra Email Interface and Kiosk Email Exchange Manager. These modules require Apache Tomcat 5.5 or above and Apache James Mail Server 2.1.2 or above.

### ***GramPatra Email Interface***

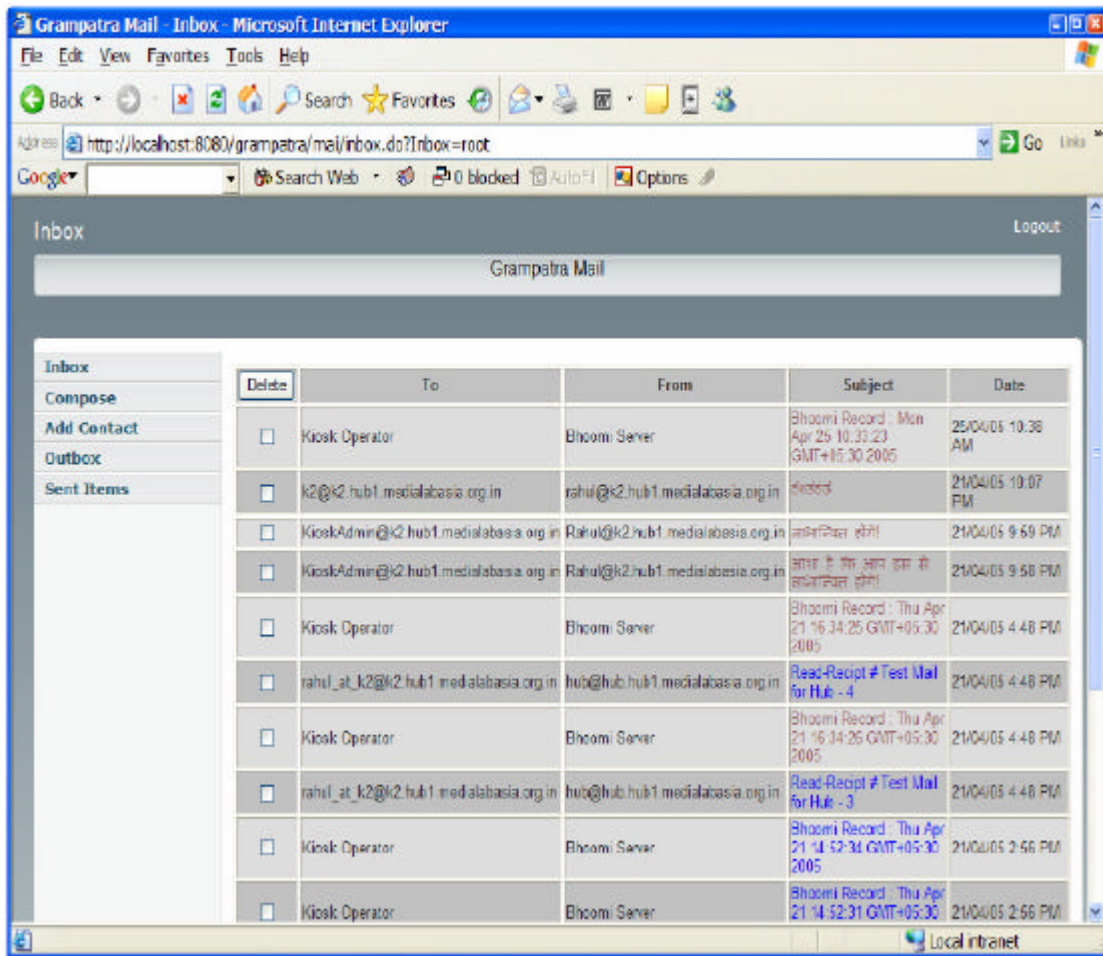
GramPatra Email Interface is a web based interface. This is further divided into two parts: Configuration Module and Email Module. Configuration module is for the administrators to keep track of all the settings of GramPatra Network. User Module provides a minimal set of email features for composing, viewing and other email related operations. This requires Apache Tomcat or any J2EE compliant web server for hosting.

We are using Apache Tomcat 5.5 as the web server. The various features provided are:-

- ◆ The GramPatra System was initially developed as single user system at the kiosks. The multi user support is under development.
- ◆ The GramPatra is Unicode compliant and currently available in two languages: Hindi and English. It is possible to develop for other languages easily.
- ◆ The GramPatra System currently provides three folders: Inbox, Outbox and Sent
- ◆ Mails for storing incoming mails, spooled mails and sent mails respectively.
- ◆ The GramPatra system allows up to three attachments with an email. This can be increased if required.
- ◆ A minimal Address Book feature is provided. User can add and delete entries from Address Book but cannot modify existing entry.
- ◆ Provides an interface for making the setting for the GramPatra Network.



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### ***Kiosk Email Exchange Manager***

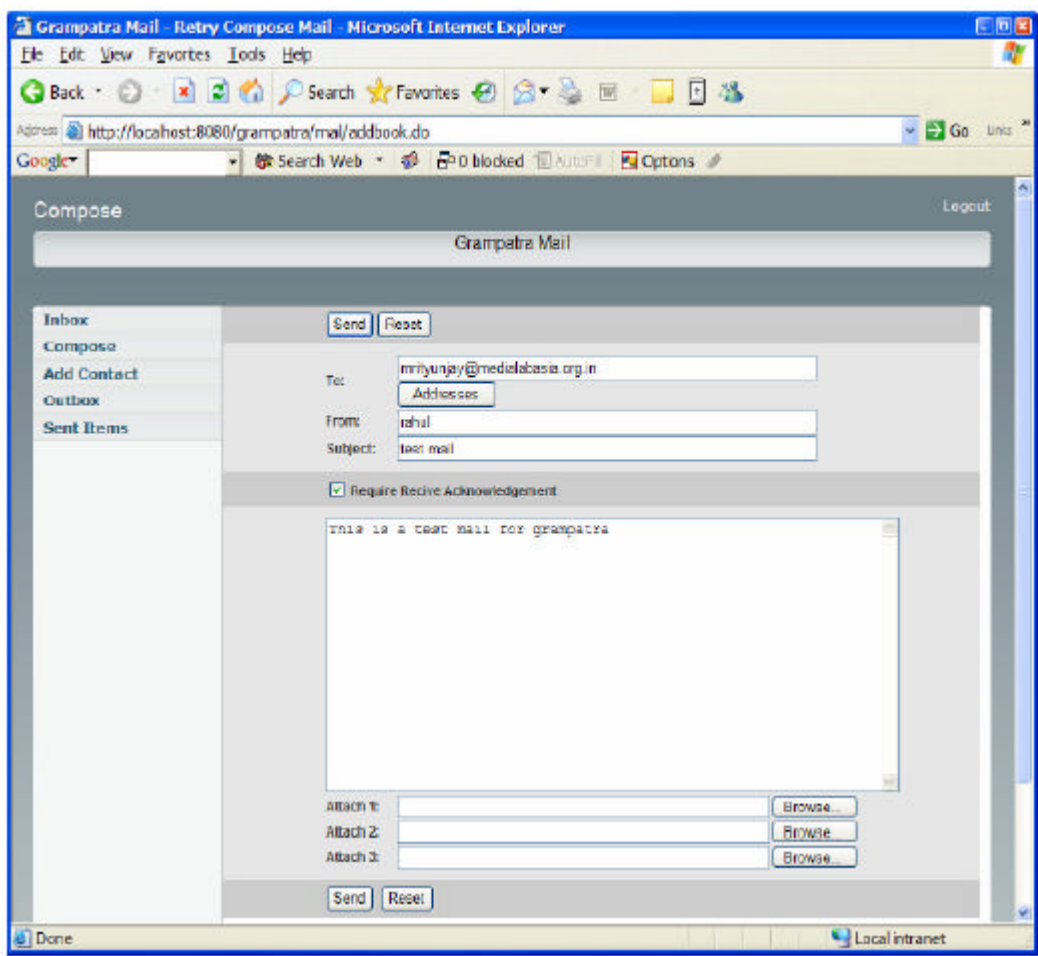
The Kiosk Email Exchange Manager runs in the background and it is not visible to the user. Wireless Email Exchange Manager keeps waiting for the Mobile Server. As soon as it receives any signals from the Mobile Server, it first ask the Mobile Server to start the transfer of emails it has for the kiosk and then if it has any mails to send to any kiosk or outside world, it transfers those mails to Mobile Server. This is automatic in nature and requires no user interaction.

### ***Gateway Email Exchange Manager***

The Gateway Email Exchange Manager runs in the background and it is not visible to the user. This is responsible for the interaction of the GramPatra Software with outside world. It forwards all the emails the system receives from internet to the respective kiosks. It also forwards all the emails the Gateway receives for sending to internet from the kiosks. This is automatic in nature and requires no user interaction.



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### Technology used in GramPatra

The GramPatra technology works on store and forward methodology based on SMTP protocol. The elements of GramPatra system -Kiosks, Mobile Server and Gateway, are IEEE 802.11X wireless equipped. Digital data transfer in the form of emails between any two of these systems happens through high bandwidth wireless IEEE 802.11X based methods.

Mobile Server is a moving component in the system and the other two components - Kiosks and Gateway are stationary. In the ad-hoc wireless network, whenever a wireless device comes within the wireless range of other devices, they can create an ad-hoc network and communicate with one another. GramPatra System exploits this property.

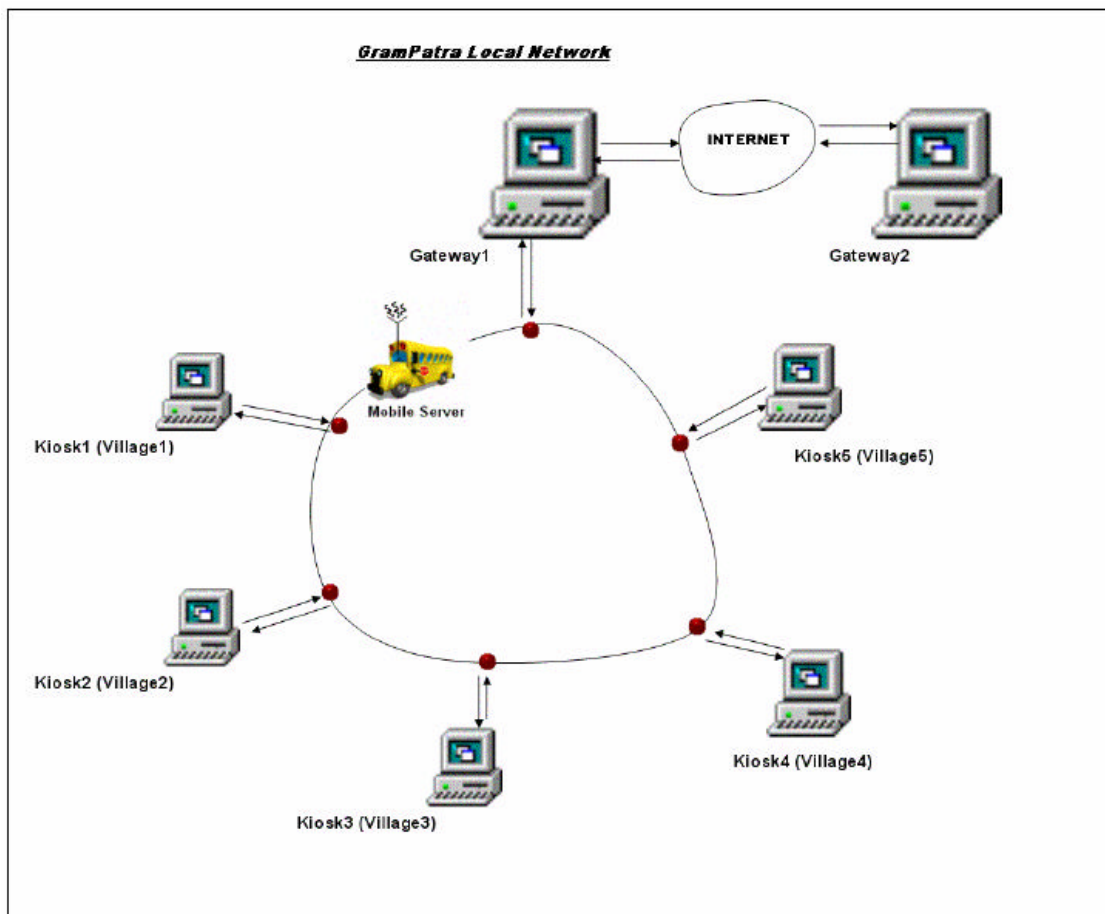
Mobile Server travels from one kiosk to another and transfers digital data as soon as it comes in wireless range of the kiosk. And when it reaches Gateway, Mobile Server transfers the digital data to Gateway which in turn can send the digital data to Internet.



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Mobile Server also makes sure that if some emails have to be sent from one kiosk to another, then these emails need not to go through the Gateway as these can be delivered directly from one kiosk to another. Gateway receives the emails from Internet for the kiosks and then forwards them to the Mobile Server which in turns delivers to Kiosks. In this way, we create a network in which Mobile Server act as the communication medium between the kiosks and the Gateway.

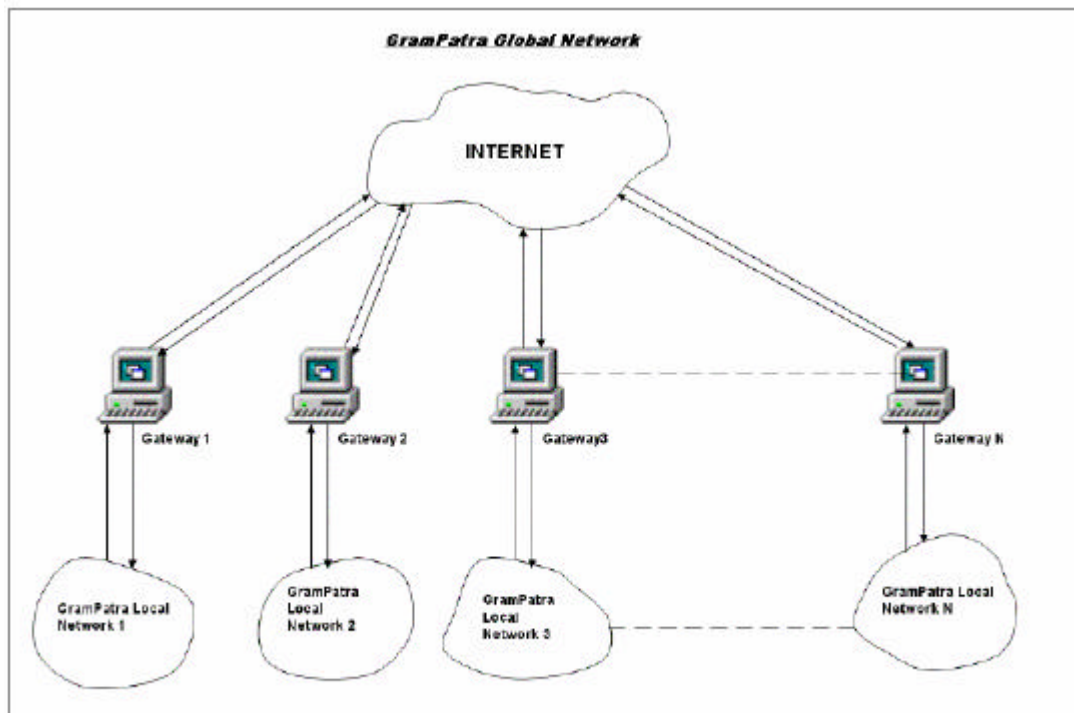
The present GramPatra system works with 802.11b wireless technology with a possible bandwidth of 11mbps. The system can also work with other wireless technologies like 802.11g with a bandwidth of 54mbps.



**Local GramPatra Network**

### **Local GramPatra Network**

More than one GramPatra local networks can connect to one another and to the internet to form a GramPatra global network.



*Global GramPatra Network*

### Implementation: Bhoomi-GramPatra Project

A pilot project between Media Lab Asia, Govt. of Karnataka and National Informatics Centre called “Bhoomi-GramPatra” is operating for the delivery of land record documents to the people in remote villages of Karnataka. In this project, Mobile Server is fitted on a public transport bus which traverses in a specific route. The requests for the land record documents are generated at the kiosk in the villages which are picked up by mobile server in the bus while it passes near the kiosk and are transferred to Bhoomi Server at Doddaballapur town when the bus passes near the Gateway system near the Bhoomi server. The requests are processed by Gateway system to automatically retrieve the corresponding land record documents form the Bhoomi Server which are then picked up by the mobile server when it next passes the Gateway system and transfers to the respective kiosk as email attachments. The land record documents are then delivered to the villagers by the kiosk operator.

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