Mobile Web and Developing Countries

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Abstract

In this paper, we argue that due to cost and linguistic reasons, a mobile web is likely to become predominant in countries like India soon. We also argue that there is a desperate need for low cost coordinating mechanisms for handling pressing social problems such as water shortage, pollution, transportation, global warming, etc. especially in guiding socially "optimal" choices in the context of problems such as current ground water/river water exploitation and pollution, etc. Here, a mobile web could fulfill an important social role. As an example of the social analysis needed in the context of a mobile web, we will examine dissemination of news through the use of paper vs PC vs mobile web in this context. We will conclude with some interesting possibilities of using a mobile web.

1 Mobile Web: The Drivers

The Web has certainly entered into the imagination of the Indian citizen. However, it is not clear that it has succeeded in going beyond the cities. The situation seems to be quite different away from these areas. A colleague[2] who spent some time ('04) recently in a small town (Gadag in Karnataka where he grew up) reports that while telephony (both wireline and wireless) is pervasive, Internet and SMS are not. The basic reason is the barrier of language. The former is language neutral while the latter are English-centric. Seeing this, some nimble manufacturers such as Nokia have recently introduced mobiles in some Indian languages such as Hindi along with some services (such as SMS, called "samasa").

Recently (mid-2006), a Hindu-CNN-IBN survey of a 3250 youth below 30 years reflecting the demography of the country (including urban/rural) reveals the following: while mobile phone is available to 18% of the youth of India, it is 4% for the rural lower class, 8% for the rural upper class but 31% and 41% for the urban lower and upper class. For an Internet connection at home, it is 3% overall[1] but 1% and 3% for rural lower and upper class but 3% and 14% for urban lower and upper class. These numbers suggest that Internet is penetrating at a lower rate than cellular, chiefly due to the cost and language issues. We discuss the cost issues further here.

It is said that at Rs 700[2] total monthly cost (leasing cost of computing device and telecom costs), Internet will become accessible to atleast 100M urban users in India and Internet can become qualitatively different and introduce newer models of social interaction[3]. Some attempts are being made to get to this cost by a public utility model and the next few years will be interesting to watch how this would be achieved. As of now, the leasing model has not taken hold and Internet expansion is primarily limited by the rate of purchase of PCs (about 1.5M to 2M per year), a costlier capital proposition for the majority of the Indian population. Note that before the deregulation of Internet in 1998, Internet expansion was limited by high ISP costs as the high license fees on ISPs were passed onto the consumer. Before 1998, there were only 0.25M Internet subscribers that jumped to 3M subscribers (and 9M users) after deregulation[6].

Since computers are still expensive (a low end system being approx Rs 20,000), an alternate device, the cellular phone, seems likely to be the agent of change for the penetration of Internet. Cellular phones have started to make a penetration in the country (esp in towns and cities) as they have become increasingly affordable and Internet that rides on it will become most likely the face of Internet in India in large parts of India. In the near future, it will be the first device for access to Web for a large number of users. According

[1] It is 7% if access outside home is also taken into account, with rural at 4% and urban at 14%.

[2] 1 USD=Rs 45 approx.

[3] At current cellular phone ARPU (average revenue per user) of approx Rs 450, the cellular subscribers in cities is growing rapidly.

to a recent report in Hindu (Feb'06), there will be 250M cellular phone users by '07 with 1.75M added every month. Economics is the principal mover here. A basic GSM phone chipset is only about $5 (approx Rs 250) while it sells for approx $40 (approx Rs 2000)[4]. Currently, using Web through cellular phones is still the exception as it is costlier per minute of airtime but the economics in the future is likely to be compelling[5].

Hence, we can conclude that a "Mobile Web" will be an important phenomenon in the Indian landscape fairly soon. However, the language aspects have to be handled well. While the cellular voice service can be said to be reasonably free of some of the ideological or cultural biases of its origins in the Western world, it is not clear that Web in India currently can be said to have this aspect. This contrasts with our eastern neighbours (China, Japan, Korea) who atleast have succeeded in eliminating one of the (Indian) Web's most obvious bias for some time: namely, the dependence on English as the default medium for communication at the consumer level when only approx 3% of the Indian population is familiar with English as a written form. Note that as a "Inglish" form (ie. colloquially spoken "Indian English"), it may be *spoken* by as much as 1 in 3 or 4[6]. Knowledge of English has certainly given an advantage to India in terms of the software and BPO sectors recently, but whether a sustainable model (for eg, based on "knowledge economy") has been found for the problem of employment and the economy as a whole is not yet settled[7]. However, one important aspect of a Mobile Web would be an emphasis on "quick and effective communication" rather than well structured prose. The language issues that have been difficult for the general Web might be less intense for a Mobile Web as semiotic aspects will be more important. Hence, simpler linguistic models (such as an intuitive GUI that requires simple interface actions) that do not need the full power of a mature language can be used immediately. This again suggests that Mobile web will spread more rapidly in the general population than the generic Web. Another aspect is that Indian languages require multiglyph support. Given the small screens, this can be problematic. This again points to a design that emphasises semiotic aspects.

2 Mobile Web as a Cost-effective Coordination Platform

Some of the major problems facing India (among many others) are:

- Low levels of employment generation which in turn is responsible for
  - Low Literacy
  - High levels of deprivation and malnutrition
  - Health problems: TB, malaria, chikungunya, AIDS
- Pollution and environmental degradation: Unsound water management such as groundwater and river pollution, etc.
- Lack of serious alternatives to oil-based fuels
- Disaster Mitigation whether manmade or natural causes

[4] A CDMA phone chipset is about $10 plus a royalty of $2.

[5] For example, the author returned a non functioning Internet landline ('03) in favour of using a CDMA 1x-RTT mobile for Internet access: a better proposition as Internet then becomes accessible at all the cities and most major towns in India whereas the landline would be much more limited. The recent introduction of broadband ('05) by BSNL at a good price point (Rs 250 per month with upto 400MB of data transfer) has again changed the equation.

[6] This claim, by Gurucharan Das[1] and others, seems exaggerated. Note that a Aug 18, '97 poll by "India Today" suggests that almost one in three Indians claims to understand English, although less than 20 per cent are confident of speaking it.

[7] The basic issue is the size of the global outsourcing economy that requires knowledge of English. The number of software jobs and business-process jobs that have gone to India so far amounts to perhaps 650,000 or 700,000, a not very significant addition when compared to what is required. According to [5], the annual addition to the working age group is around 18 million, whereas the annual addition to employment is less than 4 million. A study by Forrester Resources projects that only 3.3 million U.S. sector jobs will have moved offshore by 2015, at a rate of about 2.5L per annum, while the new entrants into the job market in India is about 70 times greater. An official task force on human resource development in the IT industry projects the figure of an additional 1.5 million IT and ITES jobs by 2009. This would still be only about three per cent of the additional job-seekers during the next five years.

Without a deeper training of the Indian job seeker, knowledge of English alone will not solve the problem, though it may be advantageous short term. Compare this perspective with the recently quoted statement of an Infosys founder that a critical need now is that "every child should be given an opportunity to study in an English-medium school".

There is a desperate need for low cost coordinating mechanisms for handling pressing social problems such as water shortage, pollution, transportation, global warming, etc. especially in guiding socially "optimal" choices in the context of problems such as current ground water/river water exploitation and pollution, etc. Here, a mobile web could fulfill an important social role. Many innovative ideas are needed to use low cost but "hitech" gadgets such as cellular phones to achieve coordination amongst dispersed agents; this is critical to reduce the costs in a price-sensitive market as well to reduce energy cost/CO2 emissions for sustainability.

A very promising technology (GIS) has long been advocated as a technical means for the aggregation and analysis of the information required for innovative solutions to many of the India's problems but the high cost of these often proprietary technologies has prevented it from realizing its true potential. With the recent models of "mashups" in "Web2.0" using "AJAX" type of technologies, these can be revisited. Consider for example, the use of Google Earth, Google Maps, NASA World Wind (or similar) to identify locations and mark events of interest (for example, epidemiological/environmental data). This might finally release the latent energies for organizing the information that is now not possible due to proprietary technologies. Recently, the government in Maharashtra in India attempted to get lands from the farmers at cheaper rates for a "special economic zone" (SEZ) saying that their lands are not fertile land. One set of farmers turned to Google Earth to use its satellite images to prove that the land is question is fertile and they should get higher compensation. A massive exercise is needed to annotate available information in many of the government of India surveys so that such "mashups" can be attempted.

Given that Indian cities are more densely populated than many Western cities, there has been less attention paid to roads (for example, the ratio of areas for roads is much less than what it needs to be, esp, for vehicular movement). Recently in Shanghai, a system has been installed that collects anonymous mobile phone position and signaling data in China Mobile's GSM network that are then analyzed and converted into travel time and speed information for major highways and surface streets. If GPS capability is also present, further developments are possible. Such a system can reduce the amount of wasted fuel and also the emissions of greenhouse gases.

Another recent use is the attempt to use the progress of vibrations in a set of disks in PCs to detect tsunamis. While it is not clear that it is feasible, it does point out that many non-traditional uses of widely distributed and available artefacts such as PCs and mobiles are possible.

For a lowcost "GIS" using satellite imagery from services such as Google Earth, we need to devise effective GIS input. Using GPS, a mobile can be programmed to use simple SMS services for sending information on, for example, groundwater usage and pollution or biodiversity mapping. Again, with mobiles, lowcost healthcare in remote areas can be developed that uses cameras to get realtime advice from experienced doctors. For example, timely information on how to handle an infestation of an economically important crop over the Web (through e-mail and video clips sent through Web) has recently ('02) helped a remote agricultural community in Madurai district of Tamil Nadu avoid major loss of income to the tune of approx Rs 1.5 lakhs.

The most important aspect in all of the above is the need to use develop mobile interfaces to backend systems. Depending on the amount of data to be transmitted, either a realtime network transmission or a disconnected operation can be chosen. In the latter case, given low cost USB-type devices for storage, a viable model could be data aggregation in USB-like devices and later transmission through computer kiosks.

Already mobiles provide some amount of tamper proof storage in SIMs. If this is increased, many newer types of applications become feasible. Just as carbon credits are being traded, micropayment schemes for socially desirable initiatives can be rewarded/traded by a parallel monetary system. Here, tamper proof storage is important in realizing this potential.

To give an another example of the need to rethink our societal options, we present a case study of delivery of newspaper contents through the traditional print route vs PC/Mobile route.

2.1 Case Study: Newspaper delivery through Print vs PC vs Mobile

Here, we evaluate and compare societal cost of information dispersal through traditional paper based mechanisms and digital/computer mechanisms. For illustration, let us consider the use of PC's for reading online newspapers. While intuition suggests that web-browsed news is far superior to carrying the costs of printing and distributing newspapers, some simple calculations reveal otherwise if a lifecycle analysis is attempted. Here we assume we are dealing with Indian newspapers that are usually 20-24 pages.

We estimate the energy costs of delivering news through the traditional print media as follows, using figures from the *The Hindu* group of newspapers in India[3]:

- *Energy cost of paper.* The energy costs of making newsprint paper are estimated to be 10 GJ/tonne. Thus, using 8 newspapers/kg, we obtain 0.375 kWh per newspaper[8]. For comparison with reading screenfuls, we will estimate the cost per A4-sheet-sized paper. Assuming 20 pages per newspaper, and 3.5 A4 pages per newspaper sheet, we see that a single A4 sheet-equivalent requires 2.75 Wh for the production of the paper itself (without printing).
- *Printing.* The *Hindu* group in Bangalore cites an energy consumption figure of 300 kWh per day for printing 75,000 newspapers (c. '98). This amounts to approximately 0.06 Wh per A4 sheet[9].
- *Distribution.* We use the figure of 2 million Joules per tonne-km for road transportation, which is approximately equivalent to 0.55kWh per tonne-km. Then, assuming 200 km of travel (note that this is an overestimate due to local editions in major cities and most readers being concentrated in cities) results in 0.025 tonne-km per A4 sheet[10]. Thus, the transportation energy spent per A4 sheet is 0.35Wh[11].

Thus, adding the three energy costs of paper-production, printing and transportation gives us a total energy cost of approximately 3.2 Wh per page.

Next, let us consider online browsing of the same newspaper: Using the 80 W power consumption (a conservative estimate given such factors as inefficient (SMPS) power supply designs[4]) for an online PC and an average of five minutes of reading per page results in 6.67 Wh per page. This is already twice the per-page energy cost of the print version. Of course, the actual value to the user browsing the web may be higher with the additional information provided *conveniently* through links. Note also that newspapers are extensively recycled in India and also used to wrap goods; hence, its ecological impact could be considered milder when compared to the toxic waste produced in non-recyclable electronics.

By way of contrast, consider the energy consumption of small devices such as cellphones that operate at 1 Watt or below[12]. While highly inconvenient right now, even assuming twice the reading time per page, this results in 0.16 Wh per page. Current devices such as Blackberry may be too cramped to do regular typing of text but they provide certain functionality well. For better results, one can possibly contemplate use of head-mounted displays or virtual reality display optics and newer types of input entry systems with low energy consumption and better ergonomics. For example, LCOS microdisplays are likely to provide inexpensive, high quality display with a low power consumption (less than 100mW). Reflective optics can be used to provide a sensation, for example, of a 21" monitor.

An additional argument, given serious shortage of power in countries like India, is that even if only 10% of its urban residents simultaneously access the web, the electric grid could experience meltdown (not to speak of extra greenhouse gases generation)! It is therefore important to consider societal options for low power Web access appropriate for developing countries.

2.2 Other Issues

Given that large number of mobiles will be manufactured, some questions wrt design of mobiles becomes apparent: should it be general purpose or designed for a special purpose? How is the obsolescence of such mass produced devices be addressed? How does one recycle it? Are special purpose devices likely to be better from the obsolescence/recycling point of view rather than general purpose devices?

3 Conclusions

A mobile web could induce participatory decision making in developing countries such as India. Just as Internet has lowered the cost of locating information, countries such as India require low cost coordinating mechanisms for organizing effective decision making. Mobile web is one promising answer.

[8] 10 GJ/tonne = approx 3kWh/kg = 0.375 kWh per newspaper (8 newspapers/kg)
[9] Assuming 20 pages per newspaper, and 3.5 A4 pages per newspaper sheet
[10] 8 newspapers per kg, or 0.125kg/newspaper is equivalent to 0.025 A4 sheets, as described above
[11] 0.025 times 0.55 kWh/40 = 0.35 Wh
[12] Example: Nokia Communicator (c. '00) requires about a watt.

References

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