



## **Rural Healthcare on lowend phones**

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### **Keyword(s):**

Internet, Emerging Markets, Mobile Widgets, Programming-By-Demonstration, Interaction

### **Abstract:**

One of the major challenges in developing countries like India is to make healthcare services accessible to rural areas. There are many Government funded projects which setup rural health centers with connectivity to a central hub of expert doctors. For effective functioning of these projects, providing anytime anywhere access to important health-related information for the health workers is crucial. However, network connectivity and adoption of computing devices are still very low in these countries. While there is huge growth in the adoption of mobile phones, more than 80% of the phones are not Internet-enabled. Therefore there is a great need for anytime anywhere access to health-related services on simple low-end phones.

# Rural Healthcare on low-end phones

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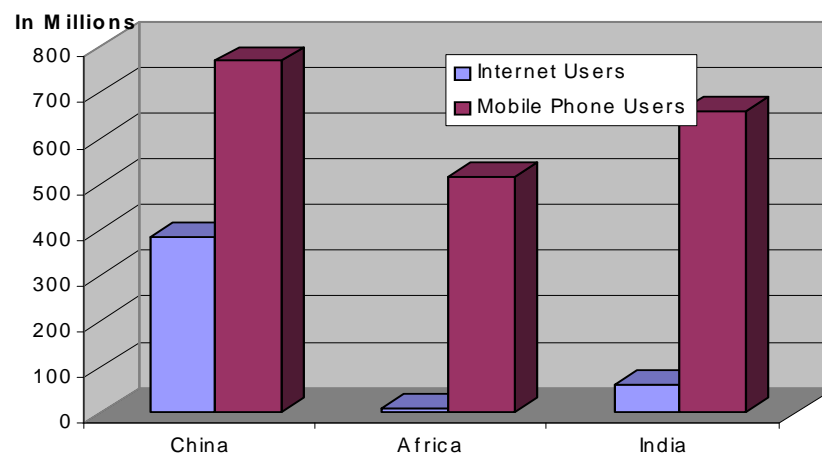
## ABSTRACT/SUMMARY:

One of the major challenges in developing countries like India is to make healthcare services accessible to rural areas. There are many Government funded projects which setup rural health centers with connectivity to a central hub of expert doctors. For effective functioning of these projects, providing anytime anywhere access to important health-related information for the health workers is crucial. However, network connectivity and adoption of computing devices are still very low in these countries. While there is huge growth in the adoption of mobile phones, more than 80% of the phones are not Internet-enabled. Therefore there is a great need for anytime anywhere access to health-related services on simple low-end phones.

We propose a solution called SiteOnMobile that helps patients, doctors and pharmacists access and upload healthcare related information from their low end phones over just SMS or voice. One of the key innovations of our solution is that it enables easy and rapid way of creating applications such as hospital appointments, checking prescriptions, uploading medical data, and such other services, all without requiring any sophisticated IT skill set. The consumers and health workers now can access relevant services offered by their preferred hospitals from their own entry-level mobile phones by just sending an SMS or by dialing in a number. We believe this solution will have a tremendous impact on emerging markets by enabling emergency services to reach end consumers at the right time. A Beta Launch of SiteOnMobile was made in July 2010 at <http://www.siteonmobile.com>. A live pilot is currently ongoing enabling voice and text-based access to Indian consumers with low-end phones. The pilot is planned to be expanded for rural healthcare in Orissa under the ASHA initiative in Jan'11.

## INTRODUCTION:

One of the major challenges for IT enablement of healthcare services is to make it accessible to rural health centers as well as end consumers at a very affordable cost at the time of need. Seventy percent of rural areas in India lack hospitals, physicians or medical equipments. To address this lacuna, many Government funded projects setup rural health centers with a connectivity to a central hub of expert doctors. There are approximately 4,000 such community health centers (CHCs) and 25,000 primary health care centers that aim at providing specialized medical care in India. However, for effective functioning of these projects, providing anytime anywhere access to important health-related information for the health workers is crucial.



**Figure 1: Growth of mobile phones versus Internet Users**

On the other hand, thanks to the growth of the Internet, several healthcare portals that give very useful information have come up and have known to be very helpful to solve even critical health issues by providing appropriate solutions to commonly seen problems. Internet connectivity also enables good Wide Area Network connectivity with uniform protocols enabling web-enabled applications to be accessed with even diverse mobile devices. However, IT adoption particularly in rural areas is very very low. For example, Internet penetration in India is less than 5% and PC adoption is just 9%. On the contrary, there is huge growth in the mobile phone usage in India and other developing countries (see figure 1). India has more than 650 million mobile phone users, which is nearly forty times the number of web users in India. Again on the flip side, more than 50% of these phones are ultra-low-end with just

voice and text messaging capabilities. Furthermore, among the others, the percentage of mobile internet users subscribed to a GPRS/data plan is extremely low. Therefore there is a great need to deliver health-related services on simple low-end phones.

In this paper, we propose a solution, called SiteOnMobile that delivers Internet experiences over low-featured phones. It helps patients, doctors and pharmacists access and upload healthcare related information from over just SMS or voice. One of the key innovations of our solution is that it enables easy and rapid way of creating applications such as hospital appointments, checking prescriptions, uploading medical data, and such other services, all without requiring any sophisticated IT skill set! The consumers and health workers now can access relevant services offered by their preferred hospitals from their own entry-level mobile phones by just sending an SMS or by dialing in a number. We believe this solution will have a tremendous impact on emerging markets by enabling emergency services to reach end consumers at the right time. The complete solution including a web-based toolset, a smart SMS gateway and dynamic voice gateway has been implemented. A Beta Launch of the solution was made in July 2010 at <http://www.siteonmobile.com>. A live pilot is currently ongoing enabling voice and text-based access to Indian consumers with low-end phones. The pilot is planned to be expanded for rural healthcare in Orissa to monitor the health of pregnant mothers and infants under the ASHA initiative.

## **MATERIALS AND METHODS**

SiteOnMobile is a novel solution developed by HP Labs India that delivers Internet experiences over SMS and Voice to end consumers on any mobile device. It includes a repository of very useful services that can be invoked either from a PC, a smart phone or any low-end mobile phone. Further, the solution enables rapid creation of such SMS /voice interfaces to content and services on existing web portals. Further, introducing a new service into our application repository is very simple and can be created in a matter of a few minutes! Furthermore, creation of new services does not require any programming knowledge!

The key idea is to view the web not as a set of websites or web pages but as a set of web tasks that one would want to frequently perform. We introduce a concept called Tasklets\* that are special type of task-based widgets that can be created by an end user without any programming. These widgets can be created by just ‘showing the action once on the browser’. The user just performs the web task on multiple websites using our special browser and the system automatically generates 1-button widget-like interactions for that task. A Tasklet basically models a web interaction as a sequence of web actions needed to perform the task on different web pages. These Tasklets are hosted in a novel cloud service and hence can be executed on diverse thin clients. We have built a toolkit and a platform to enable end-users to create such Tasklets and mobile widgets just by browsing. The solution also programs a smart SMS gateway and an interactive voice recognition system to support the new service, completely automatically.

The key novel elements of our solution are:

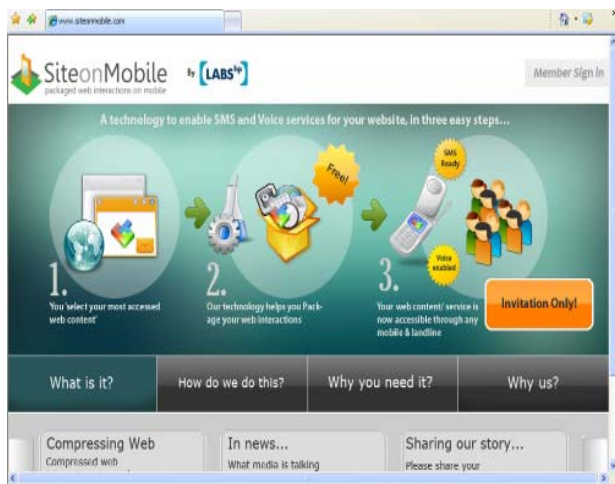
- (i) Concept of Tasklets that considering web not as *web of pages* but as *web of tasks*
- (ii) A rapid authoring tool to create new web tasks without programming
- (iii) A novel cloud service that provides device-independent way of executing a web task
- (iv) A smart SMS gateway that converts SMS codes/patterns to appropriate Task invocations
- (v) A dynamic voice portal that automatically performs text-to-speech conversions of web content being accessed by the user.

Mobile users can now invoke any useful web task using just an SMS. The message text sent from the mobile device provides the details of the web task that needs to be executed and our system performs the task on the Cloud and sends back the result over SMS.. The end consumer sends an SMS text say “weather bangalore” to a predefined SMS number and receives back the weather information from weather.com.

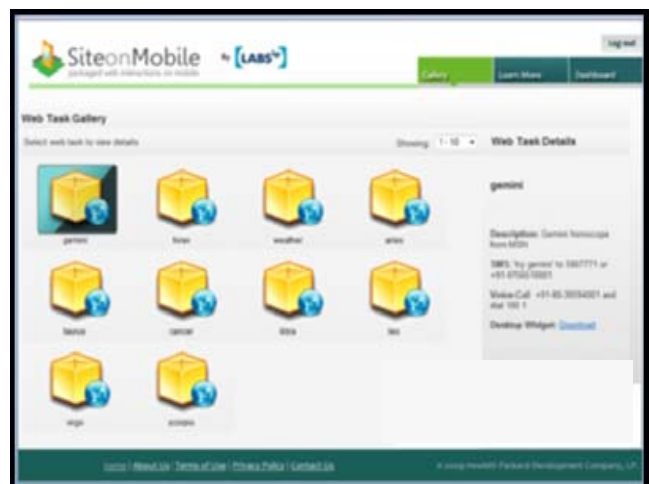
Mobile users can also access these web tasks (TaskLets) through an interactive voice recognition (IVR) Interface. Users just dial a given number. An IVR application provides voice menu and sub menu dialogues and enables the user to select the task and results are provided to the user. The end consumer dials a specific phone number for SiteOnMobile. He hears a familiar IVR system announcing the

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\* Patent pending technology from HP Labs India



**Figure 2: SiteOnMobile portal**



**Figure 3: SiteOnMobile Tasklet Repository**

Tasklet service and requesting for the 'extension number' of the Tasklet of interest, the user selects 100 for the weather Tasklet to hear the weather of Bangalore.

Essentially, there are two classes of target users for the SiteOnMobile solution:-

1. The website owners who would be interested in enabling new content/services over SMS or voice can expand their reach. (hospitals, medical practitioners, pharmacists, community portals)
2. End consumers who would be interested in accessing specific (health-related) web content or service using low end mobile phone (using either voice or SMS).

## RESULTS AND DISCUSSION

The complete SiteOnMobile solution including a web-based authoring toolset, application repository, a smart SMS gateway and dynamic voice gateway have been implemented. A Beta Launch of the solution was made in July 2010 at <http://www.siteonmobile.com>. Figure 2 and 3 show a glimpse of our authoring portal and app repository.

A live pilot is also currently ongoing enabling voice and text-based access to Indian consumers with low-end phones. The solution is hosted at <http://www.siteonmobile.com>. The access to this portal is currently in an "invitation only" mode where only selected customers will be invited to create new services. Interested content owners can send in their request to access the solution on the portal, giving a brief description of their website to [siteonmobile@gmail.com](mailto:siteonmobile@gmail.com).

The solution has got tremendous response so far with several website owners requesting access to our tools to create SMS and voice interfaces. Among them, more than 10% of the website owners are HealthCare websites from India, Singapore, UK and African countries. We are currently working with several of them to start releasing healthcare services on pilot basis. Some example services that we have created are: (a) services to update and retrieve vital signs (BP, sugar, temperature, weight) (b) a service to upload and get latest prescription from your family doctor (c) Fixing doctor appointments. More information about the solution is available at <http://www.hpl.hp.com/india/research/siteonmobile.html>

We have an ongoing collaboration with the ASHA Worker initiative to enable information access over voice and SMS for rural-health, particularly to monitor health of pregnant mothers and infants. The pilot is planned to be expanded for rural healthcare in Orissa under this ASHA initiative in Jan'11.

## **BENEFITS**

SiteOnMobile can enable primary healthcare and community health care centers in rural India, which lack infrastructure to specialized doctor consultation to their critical patients, to easily access the valuable healthcare information from hospitals web contents/services using a low end mobile phone. As an example, using SiteOnMobile solution SMS & voice interfaces could be used for consulting by rural pregnant mothers and have an impact on rural maternal deaths. Another goal is to reduce the pregnancy related mortality by increasing the awareness towards family planning. Tele-homecare will provide disease monitoring and management, patient support, and education. The technology used is based on the patient's clinical and functional needs.

Our SiteOnMobile solution allows patient's medical data such as: Glucose level, Blood pressure information, etc to be uploaded using a low end mobile phone. The solution also allows direct interface with the capturing device that will forward to a specialist doctor located in a city who monitors patient parameters, and alter medication as needed. This particular use case is currently under development and is planned to be first used for Malaria control in Orissa. The health data will be updated by health workers who regularly monitor health of such patients during the treatment period.

## **TECHNOLOGY CHALLENGE**

There are multiple technological challenges that our solution addresses. First and foremost, access to Internet content and services is currently available only for Internet-enabled, Internet-capable devices. Our solution breaks this barrier and enables even non-Internet capable devices to get the value of the Web. Secondly, using current programming technologies, one requires at least 4-6 weeks to develop a new service or a web application. We reduce that time to a matter of minutes. Thirdly, creating such services today require sophisticated programming knowledge of at least one of Java, Javascript, Servlets, ActionScript as well as knowledge of web protocols and standards (XML, HTTP, HTML, JSON, ..). We have developed a novel concept of Tasklets that can be programmed by demonstration, which enables any person who knows how to browse the web to create new programs. No programming knowledge is needed. Finally, creating SMS and voice interfaces require sophisticated SMS and voice infrastructures to be setup at the person releasing those services. We leverage Cloud technologies to completely eliminate this need for additional infrastructure by either the consumer or the (healthcare) service provider. We also enable an optional pay-per-use model where the consumer needs to pay only for the health service that he has availed.

## **ECONOMIC CHALLENGE/CONSIDERATION**

Today access to Internet is limited to PC users and smart phone users, which forms about 5% of our population. People at the bottom of the pyramid do not have access this huge source of information and services that can dramatically improve their lifestyle. Our solution enables access to Web content on even low-featured mobile devices. This has a good economic impact. Cost of a smart phone today is at least 10 times the cost of a low end phone. Further, monthly cost of internet connectivity (data plan from a mobile service provider) is pretty high that even a rich man does not see the value in subscribing for (only 2.5% of users with GPRS-capable phones actually have proactively enabled data plan). Our solution enables a poor man to come online, with just his Rs 1000 phone and 2 paise SMS ! Our solution is also cost effective to the health-care service provider since he need not invest in the call center, SMS gateway and the web-access infrastructure.



## UNIQUENESS

Several healthcare portals and community websites today give very useful information and can be very helpful to solve even critical health issues by providing appropriate solutions to commonly seen problems. However access to these websites in emerging markets like India is severely limited as penetration of Web in India is less than 5%. Also, given that number of mobile phone users is 10 times more than the number of PC users, phones are the most appropriate access devices to such healthcare information. We solve most of the above limitations, and provide the value of the web, particularly health-related information, to a common man through low end mobile phones.

From a technology perspective, there are primarily four approaches in use for providing internet content/services on low-end mobile phones, though not very common:

- (a) Search based: Google [3] and Yahoo [4] allow users to send search queries by SMS and an appropriate response is send back via SMS again. Due to the limitations of the length of SMS, it is difficult to show the search result that is most useful to the user. This service is therefore not used much at all.
- (b) Application based: Most of the companies develop separate mobile applications that integrate with their system to provide SMS based services (IRCTC provides railway ticket enquiry over SMS). Also, special interactive voice recognition systems are setup for every business wherever a call center can be afforded. This is typically feasible for high value transactional services and not for long tail or SMB-driven services.
- (c) Spoken web [5] is an IBM initiative that proposes an alternate network of VoiceSites called WWTW (telecom-web) for only voice driven applications with new protocols and website formats. The problem here is that it requires a whole new ecosystem change unlike ours that works on existing websites.
- (d) TxtWeb [6] is another recent initiative to deliver web content over SMS. Here again, the solution requires a developer to create new web applications in Javascript conforming to TxtWeb API so that SMS interfaces can be given. Our solution does not require any programming and can be used by an end user to create new SMS and voice interfaces.

Additionally, our solution enables user-created mobile web tasks, can take user inputs, performs SMS/voice conversion in a completely automated way without requiring user to write a single line of

code, or change the current format of the websites, which is not possible using any of the above approaches.

## **EXAMPLES OF SUCCESS OR CASE STUDIES IF ANY**

Currently, our application repository at <http://siteonmobile.com> has over 60 free services that can be used by consumers. They include some common services such as weather information, currency conversion, daily horoscope, checking train ticket status, etc. Additionally, we have partnered with 12 website owners to release business-specific services, such as checking the status of an order, alerting available-job opportunities to a user, getting bank rates for specific banks and so on. From a healthcare perspective, we are working with healthicare.net to provide example tele-medicine services such as: (a) a set of services to update and retrieve vital signs (BP, sugar, temperature, weight) (b) a service to upload and get latest prescription from your family doctor (c) Fixing doctor appointments. (d) To track the health of malaria patients during treatment.

Finally, we have an ongoing collaboration with the ASHA Worker initiative to enable information access over voice for rural-health. Information on child delivery process, child information (Height, weight, POL, DPT, MEA, BCG, HB, TMP), Visit information like (BP(sys), BP(Dias), HB, TT, FGM etc) and patient information's.



These and many more example services are accessible for registered users at <http://siteonmobile.com> and the registration is currently open to all free of cost.

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