

# MSwasthya: Cost Effective Solution for Local M-Search of Health Care Services and Providers in India

## ABSTRACT

The dramatic growth of India's mobile services industry has vastly improved the abilities to provide access of information to the Indian users at the click of the widget. This paper investigates the role of this industry in providing healthcare to Indian citizens and introduces the features, software architecture and benefits of MSwasthya software solution which is being designed and implemented by SEETA (Software for Education, Entertainment and Training Activities). MSwasthya is a cost-effective attempt to provide local search of health care services and providers in India. It is designed for use by general users and the human interface guidelines for this application have been developed to ensure its applicability among the first-time users of mobile phones. The paper also discusses the various use-case scenarios of the application and its unique advantages over other available alternatives.

## Categories and Subject Descriptors

### General Terms

### Keywords

Local search, healthcare, human interface guidelines, global positioning system, mobile services, mhealth.

## 1. INTRODUCTION

### 1.1 The Mobile Services Explosion

Work on India 2011 Census has begun, but this time, there has been a departure from the regular monotonous decennial exercise. It has been aptly recognized that the Census for a vast and heterogeneous country like India, can be mined for richer social detail and this realization has resulted in inclusion of various crucial parameters, including inter-alia, ownership of a mobile telephone, in the ambit of its data collection. The Indian telecommunication sector which has witnessed tremendous growth since the advent of the century has gained momentum and today, it is the third largest network in the world and second largest in terms of number of wireless connection. Mobile cellular subscriptions have increased at a compound annual growth rate of 59.4% during the period 2003-08. The mobile subscriptions per 100 inhabitants have increased from 29.36 in 2008 to 40.77 in 2009 [1]. Today, mobile phones have become a ubiquitous technology with over 525 million population across India owning a mobile connection [2]. It is projected that India will have a 'billion' plus mobile users by 2015, adding around 10-12 million monthly subscribers on an average [3].

### 1.2 Boom in the Health Care Industry

Complementing the boom in mobile telephones is the Indian health care industry, which is also virtually poised for a revolution. The \$ 45,000 million health care industry, employing around 4 million people, is growing exponentially, largely due to the increasing per capita health spending by consumers and huge

investments by the private players [4]. This scenario has led to harnessing the power of mobile networks, and in the process has fueled a proliferation of mobile based health services. Along the continuum of technology in health care, diverse health applications covering various areas including health administration, health care delivery system, health information and patient care, are being used in different ways, depending upon the specific requirements of the country [5]. Innovative health care initiatives are crucial for improving health care in order to work with the emerging demands and challenges like changes in the pattern of diseases, increasing life span and attaining the Millennium Development Goals. Mobile health mobilizes health care and health responsibilities by allowing the consumers better control and direct interaction as well as interconnectedness with the important players in the health system. Ever decreasing costs of handsets along with the ability to quickly deploy cellular networks has led mobile phones to penetrate even in remote areas. The easy-to-use mobile platform, allowing access to less technology literate groups, has provided an enabling environment and unleashed powerful opportunities in addressing new challenges in the health research system in order to attain key health outcomes.

### 1.3 Mobile Phones with Global Positioning System (GPS)

The recent advances in technology have led to a spurt in location based services using GPS, which can yield higher resolution data in outdoor settings. Mobile based navigation is taking shape and India is all set to adopt and adept the new technologies. Most high-end phones come with an inbuilt GPS receiver. However, many factors thwart its adoption. Cost of the device has been an important issue for this category of phones. Such a facility is available only in high end phones costing over \$ 225 [6]. Another constraint in the use of GPS is the lack of awareness with regards to its technology amongst the users. Improving the existing poor quality of digital map data is another big challenge for the industry. This would necessitate high maintenance on account of considerable complexities involved in building a map database. High import taxes/duties on GPS equipment, poor penetration levels due to discouraging rules and regulations and misplaced security concerns have all compounded the woes of the GPS industry [7].

### 1.4 Unavailability of Local Search Service for Healthcare

Presently, there is no local search application on mobile phones for gaining access to information about local health care services and providers in almost all cities in India including Delhi, the capital city. The users resort to accessing local search health information on local search WAP sites or websites. The aforesaid, at times do not yield the best possible solutions. Very often, data is found to be incorrect and biased, because of commercial considerations. Accessing information on mobiles, through the websites, could also cost the user substantially, unless the website has been optimized for mobile phones. Finally, the importance of

using a trusted source for searching information on health care services need not be overemphasized.

Section 2 of this paper gives an introduction to the MSwasthya product and its unique features, human interface guidelines, technical specifications and requirements for its implementation. Section 3 details the architectural design and its implementation. Section 4 investigates the use-case scenarios of the application and its unique advantages over other available alternatives. Section 5 gives a visionary idea about how this product would evolve or face challenges with changing times and needs of the society or communities.

## 2. MSWASTHYA

MSwasthya, wherein 'M' refers to mobile and 'Swasthya' stands for health - enables access of updated information regarding health care providers and services, thereby facilitating decisions resulting in improved health outcomes for the population. Further, it provides information relating to health events, as well as community health alerts. This application also empowers all healthcare providers to add, modify and delete information through a Web 2.0 service – <http://www.mswasthya.co.cc/>, which has easily been integrated with this application in order to maintain a dynamic and updated database. Further, this application which is like a 'one-stop health resource platform' provides the user an opportunity to not only write blog entries but also give feedback on any application related issue and share health resources in the form of videos and awareness posters.

### 2.1 Stakeholders

Apart from the users, this product also aims to target all health care providers and their services.

#### 2.1.1 Citizens and Tourists:

This application cuts across income and age barriers. Being capable of working across a wide range of mobile sets, including some low end ones, it offers results for most mobile owners, across all socio-economic groups. Further, a child to a geriatric can navigate easily through the application, which allows easy back and forth movements.

#### 2.1.2 Government:

Keeping in view the transparency in the functioning of the Government, this application has the capability to deliver details of all health care providers, including those on the panel of Central Government Health Scheme. Further, it would help in awareness generation for various services, including those related to *licensed blood banks* and *organ donation centres (eye banks, etc.)*. Being capable of giving instantaneous results for providing information relating to nearest *emergency services and ambulances*, this application would help to instill a feeling of security amongst the users. It would also help in providing health related information/events, e.g. pulse polio, camps on HIV/AIDS, TB and so on.

#### 2.1.3 Pharmacies and Medical Equipment Outlets:

Apart from furnishing contact details and address, special information about 24 hour pharmacies, surgical equipment outlets, etc. would also be available.

#### 2.1.4 Specialists Including General Physicians:

Information relating to all the doctors not working in Government Hospitals/dispensaries can be accessed specialty-wise. The specialties included are the most commonly used ones like cardiologist, gynecologist, pediatrician, orthopedic, dermatologist, nephrologist, dentist, etc.

#### 2.1.5 Diagnostic/Imaging Centres:

The wide choice available of such facilities across the national capital of India, can be easily searched location wise.

#### 2.1.6 Health and Fitness Centres:

Users seeking information on health care and fitness services e.g. information on health clubs and yoga and fitness centres will also find the application to be useful.

## 2.2. Features

- Myriad categories have been conceived, after in-depth survey of user requirements
- Detailed area information with pin code is provided.
- Comprehensive information in a consistent data format.
- Image display has been kept optional.
- Easy screen navigation which facilitate quick back and forth movements with jump options, empowering the user to carry out multifarious searches.
- Portability across all devices ensuring development cost reduction.
- Midlet is not hard coded with local host as the server as it takes the server URL from the Midlet JAD configuration file.
- Minimum click model for satisfying user experience.
- Modular and scalable architecture
- Having complete control over the display options in MSwasthya, the server allows the display lists to be changed, in accordance with the current health demands e.g. swine flu outbreak, information desired by the users, and the feedback received from them.
- Future provision for customizing the display options in accordance with the logged in user eg. users from different Indian states, with different requirements et al.
- Ticker has been used to apprise users about relevant and timely updates.

## 2.3 Graphical User Interface (GUI)

MIDP applications are expected to run on myriad different mobile phones without modification. This is particularly difficult in the area of user interface; Mobile Information Devices (MIDs) have got screens of all sizes, in grayscale and in color. Furthermore, for input, the MIDP is fairly open-ended: The input devices on MIDs vary widely in their abilities, from numeric keypads to alphabetic keyboards and soft keys to touch screens. The minimum screen size mandated by the MIDP is 96 x 54 pixels, with at least one bit of color depth. [8].

## 2.4 Some important human interface guidelines which steered the design of MSwasthya's U.I.

- User Interface kept simple and user friendly to provide relevant search details without any complications.
- Use of high level APIs, in order to ensure portability of the application across different mobile phones.
- MIDlet does not assume any keys other than those defined in the Canvas class.
- Use of RMS for login: Provision for the user to configure the MIDP client to cache the account credentials, so that it is not required to manually sign in every time.
- Entering data through a handheld device can be tedious. Hence, a list of choices is presented to enable the user to select his option.
- Image display has been kept optional as image downloading would cost and may not always be required by the average Indian user.
- MIDlet has been made independent of any specific screen size; the image gets scaled and recoloured appropriately in accordance with the device in use.

## 2.5 Tools

NetBeans IDE 6.5, with its inbuilt Glassfish V2 Server was used for development and deployment of MSwasthya's client and server end. MySQL Server was adopted for the backend database. Sun's J2ME wireless toolkit provided the emulation environment. The minimum requirements for running the application are CLDC 1.0 and MIDP2 .1. The application was successfully tested on Nokia, Samsung, Sony Ericsson and Motorola Emulators.

## 3. ARCHITECTURAL DESIGN AND IMPLEMENTATION

### 3.1 Client and Server

When the user starts the MIDP client, the login screen appears at the outset. The screen has two text boxes in which the user is expected to fill in the account ID and the relevant password. The authentication is done by Login Servlet at the server end which allows us to maintain the session information through the Http Session class.

Figure 1 shows MSwasthya's workflow diagram.

### 3.2 Server Side Application Design

The server end consists of different servlets, which process the information, by capturing the parameters, submitted by the client, during different search operations. After duly processing the client requests, at every stage, the corresponding servlets return the results to the client.

MSwasthya's server end primarily comprises of three modules as under:

#### 3.2.1 Servlets,

To process different types of functions, different servlets have been used in MSwasthya.

- Login Servlet – To handle the client's login operation
- Image Adapter Servlet - A simple example of a servlet that reads the image from a given URL and converts it to PNG format, scaling it and recoloring it appropriately for the device. Can be called using either GET or POST.
- InfoServlet – This has two functions that handle the similar tasks of giving extra information about an area or a result, when a viewer requests for complete information.eg. all details about a hospital- its address, contact number.
- Main Menu Servlet – Is responsible for presenting the main list of the categories, areas, and results to the user, by taking the input keyword and the user selections as parameters.

#### 3.2.2 DB Classes

The search list specific DB classes – these use jdbc to establish a connection to the database by using a suitable driver and have methods that perform common database functions, such as querying the database in accordance with the selection of different choices by the user at different levels of the application, and using the keywords (if any) typed by the user for different search operations et al.

#### 3.2.3 Entity classes.

The entity classes- A Java object that maps to a database table is called an entity class. It is a regular Java object (also known as a POJO, or plain, old Java object) with properties that map to columns in the database table.[9] MSwasthya makes use of multiple entity classes that map to the different tables in the MSwasthya database.

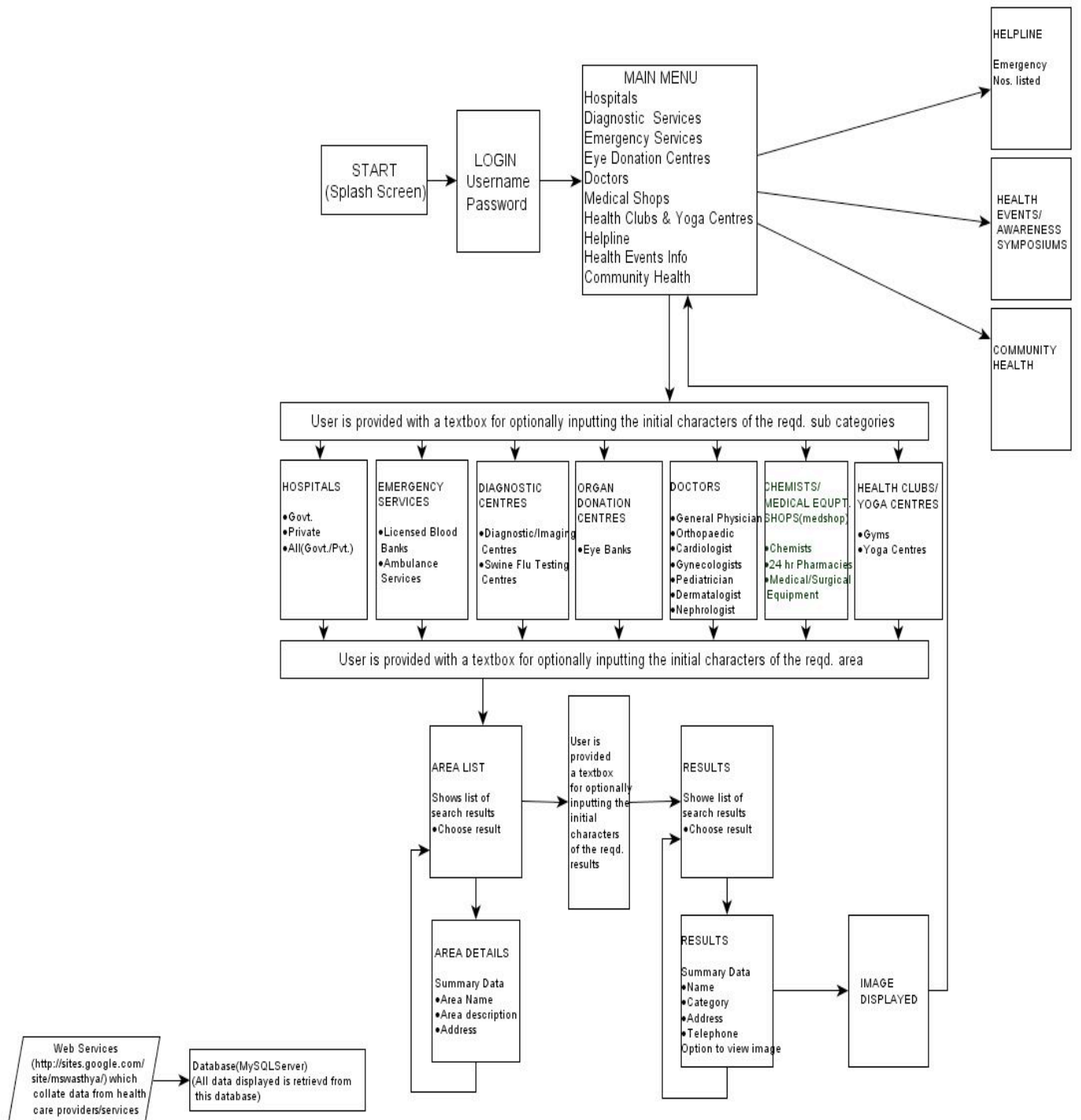


Figure 1. Workflow diagram of MSwasthya

After a successful log in, when the client makes a selection from the category list returned by the MenuServlet and proceeds to make other selections and/or enter keywords, the servlet captures all these parameters entered by the client, interacts with the instances of the DB classes and the entity classes to retrieve the correct results from the database and returns the search results to the user.

### 3.3 Networking

In MSwasthya, in order to allow the application to be portable across all mobile phones, HTTP connection is used to connect the client to the server. HTTP is a request-response application protocol where the GET or PUT commands are used to supply data. In MSwasthya, GET method was used, where the data of the request becomes part of (encoded in) the URL. Since the client's requests do not contain large amount of data, there is no risk of overrunning the capability of environment variables.[8].

### 3.4 Performance Issues/Constraints

- The number of trips to the server had to be kept to the bare minimum to save on cost, time and minimize user effort to give the required results.
- Jar size
- Reengineering (Security Issues)

## 3.5 Obfuscation

### 3.5.1 NetBeans Obfuscation Configuration:

Netbeans inbuilt open source obfuscator, Proguard was used. Obfuscation is easily made part of the build process by simply setting the level of obfuscation required in the project properties. Two benefits of Obfuscation

- *Footprint reduction*

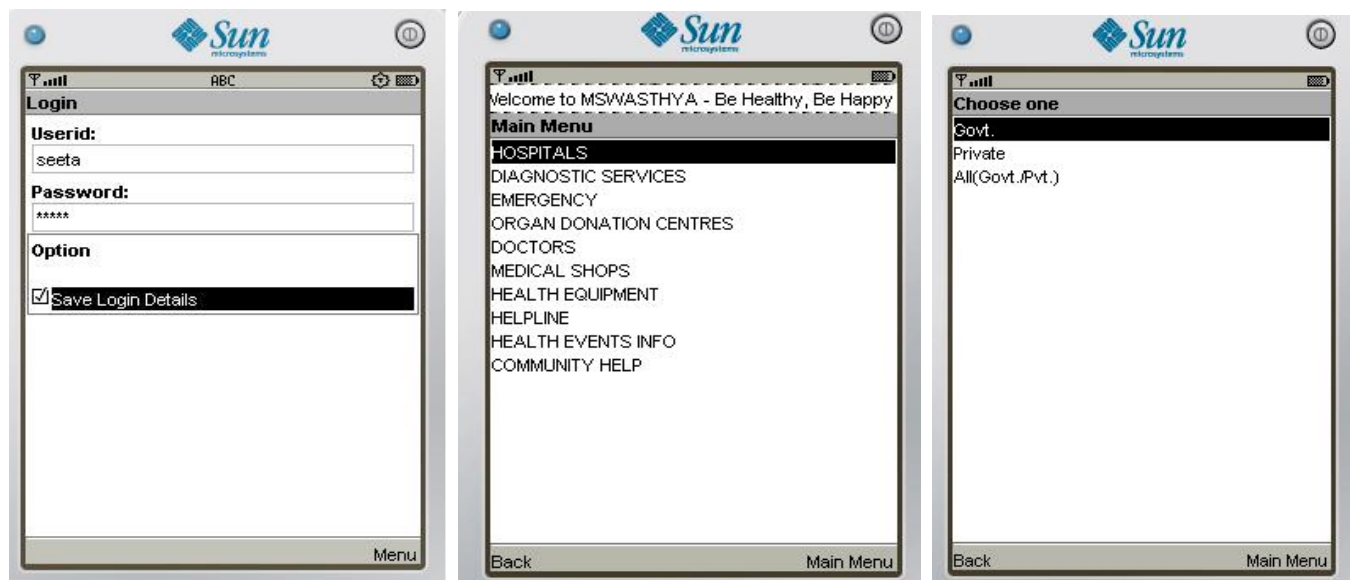
Non-obfuscated jar size	Obfuscated jar size	% Reduction
86kb	74 kb	13.95

- *Protection of intellectual property:* Obfuscators make it harder to decompile the code, thus making it more secure.

## 4. USE CASES

### 4.1 Use Case 1: Search To Obtain Information About Health Services

Suppose a user has an immediate requirement to find a hospital in the vicinity but has financial constraints. Some selected screenshots from MSwasthya below show the steps involved in helping the user to quickly locate such a hospital with minimum clicks. The speed of result retrieval can be enhanced if the user types in the first alphabet of his preference areas in the optional text box.



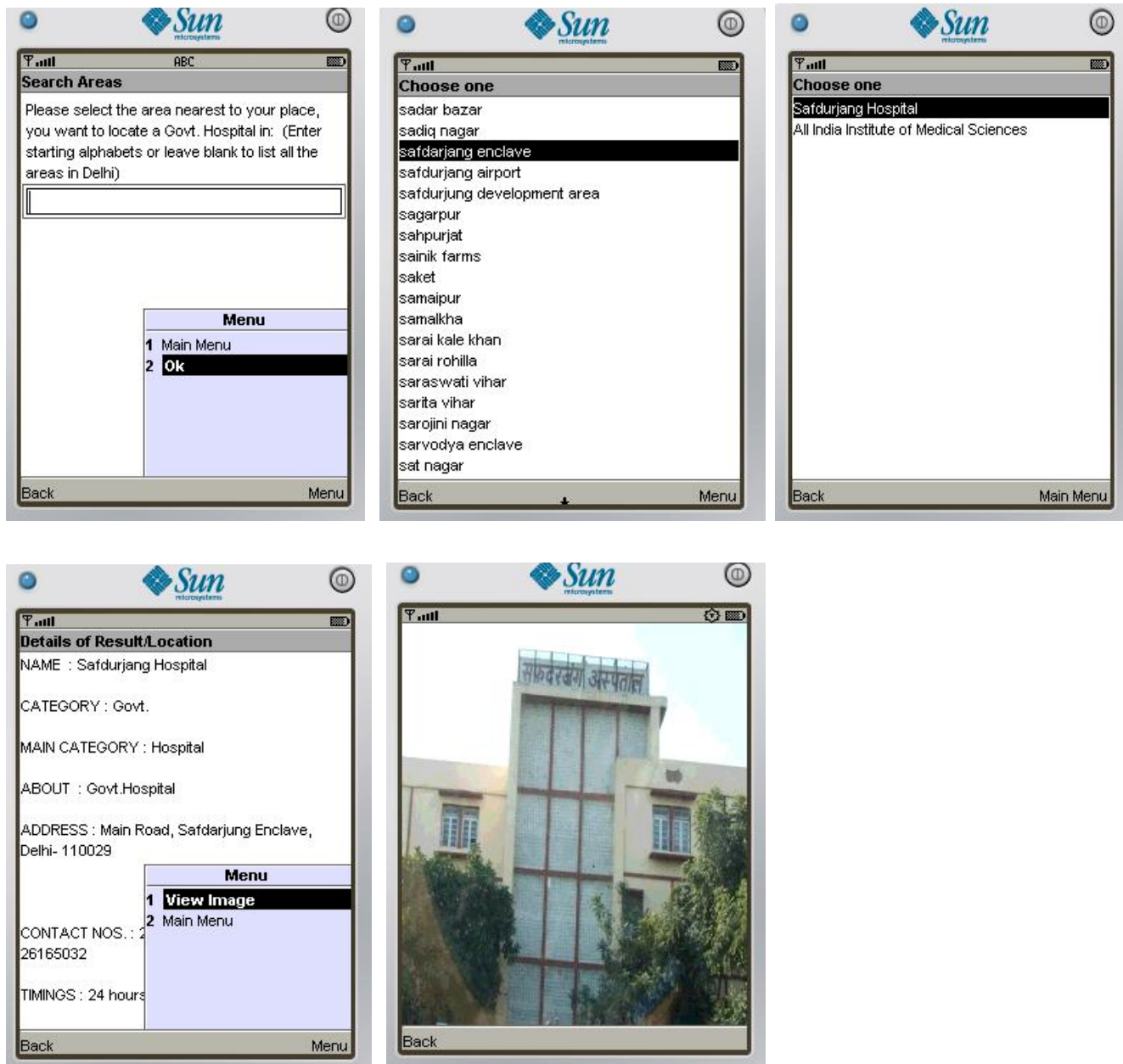


Figure 2. Screenshots for searching a hospital using MSwasthya

## 4.2 Use Case 2: Emergency Services:

- “Helpline” option in MSwasthya: There is an emergency and the user needs to access important numbers of ambulance services, accident and trauma help lines, hearse vans, et al.
- “Community Help” option flashes requests made to the community by the users who are in immediate need of medical help for family/friends-e.g., a matching blood group



Figure3. Additional information about Emergency Services

### 4.3 Use Case 3: Additional Health Information

The application has the capability to flash updates about the important health events/awareness symposia being organized in the capital.

## 5. FUTURE SCOPE

- This application although Delhi-centric, after receiving a feedback, both from the users and the health care industry, can easily be replicated across States, keeping in view its scalable and modular architecture.
- Use of vocabulary that maps with the local content of different Indian cities.
- More categories like health foods, health related issues for pets, including veterinary doctors, as well as nurses and paramedics can be added. Providing micro level details of information in the existing categories, e.g. detailing the various services offered in the diagnostic/imaging centres and thereby enriching the quality of provided information, is possible.
- Local maps giving the location of various health care providers/services can also be integrated with the existing application.
- It has been seen that around one-third of the mobile subscriptions are receiving health tips on mobiles, making this SMS VAS service as one of the top 7 popular SMS-VAS services in India. [3]. Accordingly, inclusion of a feature on health and safety alerts in the application is feasible and would be a relevant for the Indian audience.

## 6. CONCLUSION

In this paper, an attempt has been made to demonstrate the modalities of how MSwasthya aims at ameliorating health search services in Delhi, the capital of India. Through this

application, the users are provided with cardinal details about health care services, their providers and other health related updates, at minimum cost. Apart from being inclusive in its approach, the other strength of this application is to find an optimal search solution keeping in view the interplay of diversity of health care industry, the needs of the community and the service expectations of the users.

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## 8. REFERENCES

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