ISSN 2250-3153

Cell Phone Technology: "Substitute or Complement to Web Based Services"

Shamim Ahmed, Nur-ul-Arafat Shomik, Fayyaaz Mushtaque

* BRAC University, Dhaka, Bangladesh

Abstract- In this modern era, the communication technology has always advanced at a tremendous pace. Along with that our dependency towards electronic devices also has grown to a larger extend. At present, cell phones are the most widely used electronic device worldwide. As technology advances, this little device is being capable of doing almost everything. Now we can use cell phone for web browsing, instant messaging, bill payment and for many other purposes. Modern people are using their cell phones to do what they used to do with their computer and internet. This thesis report emphasizes on people's adaptability and conveniences towards cell phone technology and their motivation to switch from web services to cell phone services. This report consist of detailed review of our survey results which we conducted as part of our pre-thesis to judge current social scenario of cell phone & web users, people's interest towards using cell phone services and their thought on the system that we intended to develop as part of our thesis. It also consists of the system design of our implemented system. Our objective is to prove the potential of cell phone services as the substitute or complement to web based services.

I. INTRODUCTION

1.1: Background

Mobile phone usage throughout the world is increasing at a very fast pace. In economically advanced world it has already flourished to its maximum, and recent facts say that the number of mobile phone users in developing countries is also booming rapidly. Various researches conducted on this topic that took place in low-income regions show cell phone has an enormous possibility of taking over the place as the principal communication means for mass population of the whole world.

To utilize this opportunity to reach the mass people up to root level with various services that are now accessible only to people privileged with more expensive technologies, new ideas are needed to be developed and implemented. Hence we thought of investigating about the existing expectancy for a new service and the feasibility of implementing such a service. We aimed to innovate and initiate a new trend of mobile based services which would be a model for other service providers.

As the commencement for our goal, we studied the existing services based on mobile phone and also the global and local scenario of mobile phone usage. Our study encouraged us to work with more complex services than that are available on cell phone.

Let us at first look upon some facts from global and national perspective on this regard.

1.2 Our proposition: A brand new service with cell phone

We thought of introducing something totally new and innovative in the domain of Cell Phone based services, something that could change people's view about them. Several services were already in the market, and several others were about to launch. When we analyzed them, we found many of them to be entertainment based; whereas we wanted to create something practically useful. However, a few existing services were of this sort, but they were using only the simple features like single SMS help-lines, etc. An implementation of a more complex service would allow more facilities in public life. Our goal was to relocate a service from internet to cell phone, which could have impact on the mass people's life if available this way. Hence we come with the concept of implementing a system for accessing job databases with cell phones: a "**Job Access System**".

1.3 A Brief as How a System is being Developed (In General)

- Once upon a time, software development consisted of a programmer writing code to solve a problem or automate a procedure. Nowadays, systems are so big and complex that teams of architects, analysts, programmers, testers and users must work together to create the millions of lines of custom-written code that drive our enterprises.
- To manage this, a number of system development life cycle (SDLC) models have been created: waterfall, fountain, spiral, build and fix, rapid prototyping, incremental, and synchronize and stabilize.

The oldest of these, and the best known, is the waterfall: a sequence of stages in which the output of each stage becomes the input for the next. These stages can be characterized and divided up in different ways, including the following:

- **Project planning, feasibility study:** Establishes a high-level view of the intended project and determines its goals.
- **Systems analysis, requirements definition:** Refines project goals into defined functions and operation of the intended application. Analyzes end-user information needs.
- **Systems design:** Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.

- **Implementation:** The real code is written here.
- **Integration and testing:** Brings all the pieces together into a special testing environment, then checks for errors, bugs and interoperability.
- **Acceptance, installation, deployment:** The final stage of initial development, where the software is put into production and runs actual business.
- **Maintenance:** What happens during the rest of the software's life: changes, correction, additions, moves to a different computing platform and more. This, the least glamorous and perhaps most important step of all, goes on seemingly forever.

II. SURVEY REVIEW

2.1 Introduction

To implement a completely new type of service we were required to check its feasibility first. We conducted a survey with an objective to measure the amount of local people's willingness to shift to mobile services from web based services if available and how much adaptable they are to mobile phone technologies.

2.2 Survey Conclusion

The survey was used as a means of collecting information from general people about their cell phone use tendency and curiosity to adopt new services with cell phones. Facts that were found consist of a mixture of positive and negative sign for our proposal, although positive responses outnumbered negative ones. After reviewing the statistics found in the survey, following decisions can be made:

- The 100% of surveyed subjects have mobile phones.

It shows how cell phone has spread out among general people in Bangladesh. It also indicates the importance of Mobile Phone based Services here.

- 80% subjects are aware of web services, from which 72% use job websites to search jobs.
- This 80% web users will help in deciding if the regular web users are inclined to migrate to Cell Phone services from regular web services.

• 100% of our test subjects use SMS on their cell phone, 68% of our test subjects use Value Added Services (VAS), although about 35% of don't think VAS is useful.

- 65% thinks VAS is useful.
- This is a sign that people are already used to using VAS while most of them thinks VAS are useful. So, a new value added service has a good possibility of being accepted by general people.
- 67% of our test subjects liked the concept "Applying to jobs are now just 2 SMS away".
- Applying to jobs through SMS is likely to become a popular and useful service, because majority of the participants thought the concept was good. Although some of the participants had web access, they liked the idea.
- More than 70% of our test subjects' think "Instantly informing you about job posting suitable for you over SMS" is the best service they can think of.

Most of the participants thought that mobile phone can be very useful as a means of notifying about available jobs. Personal computers still do not have the mobility of being carried, and mobile users get to know instantly as an SMS is received by their cell phone. So they prefer cell phones as a means of notifications.

III. SYSTEM DESIGN

3.1 Our System

After studying (1) the background of Cell Phone in Bangladesh, (2) the survey outcomes and (3) the current scenario of services provided through cell phones, it can be decided that the proposed service must have following characteristics:

1. The complete process has to be very easy to understand and learn.
2. At every step, users have to be provided with thorough guidance.
3. The service has to be completely obtainable through cell phones.
4. The number of steps needed to use every feature of the service has to be reduced to minimum.
5. Various features should be available with just one registration.

Now, a design has to be developed for the service and the complete system which fulfills this requirement. For that and to make it user-friendly, these measures were taken:

- The system was designed based on Human Computer Interaction (HCI), a discipline of Computer Science, which basically studies machines' interactions with human beings and suggests effective ways for designs.
- Different types of Value Added Services (VAS) were studied and SMS and IVR were selected for this project.

HCI and different types of VAS are discussed later in this chapter.

To manage the system, three different interfaces are needed for three types of user agents. They are:

1. **The Job-seekers:** They are the core users of this service. A complete cell phone based system is needed for this part of design.

2. **The Employers:** This type of users will provide job opportunities for job-seekers, while benefiting themselves by accessing a large available job-seeker database. This module does not require to be implemented with cell phone, so a web-solution will be good enough for it. Employers will access the database through internet with the web-browsers on their desktop computer.
3. **The System Administrators:** They will administer and manage the whole system on the server. So this part has to be implemented on desktop. For this module web-based admin panel was selected, which will be

accessible to administrators through web-browsers from any computer provided internet connectivity.

3.1(A) Human Computer Interactions

Human-Computer Interaction (HCI) is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. A basic goal of HCI is to improve the interactions between users and computers by making computers more usable and receptive to the user's needs. Specifically, HCI is concerned with:

- Methodologies and processes for designing interfaces (i.e., given a task and a class of users, design the best possible interface within given constraints, optimizing for a desired property such as learning ability or efficiency of use)
- Methods for implementing interfaces (e.g. software toolkits and libraries; efficient algorithms)
- techniques for evaluating and comparing interfaces
- developing new interfaces and interaction techniques
- developing descriptive and predictive models and theories of interaction

A long term goal of HCI is to design systems that minimize the barrier between the human's cognitive model of what they want to accomplish and the computer's understanding of the user's task.

Professional practitioners in HCI are usually designers concerned with the practical application of design methodologies to real-world problems. Their work often revolves around designing graphical user interfaces and web interfaces.

Researchers in HCI are interested in developing new design methodologies, experimenting with new hardware devices, prototyping new software systems, exploring new paradigms for interaction, and developing models and theories of interaction.
HCI differs with human factors in that there is more of a focus on users working with computers rather than other kinds of machines or designed artifacts, and an additional focus on how to implement the (software and hardware) mechanisms behind computers to support human-computer interaction. It means that human factors are a broader term, and human factors of computers can be described as HCI - albeit some experts try to differ in these areas.

Design principles:

When evaluating a current user interface or designing a new user interface, it is important to keep in minds the following experimental design principles:

Early focus on user(s) and task(s):

Establish how many users are needed to perform the task(s) and determine who the appropriate users should be; someone that has never used the interface, and will not use the interface in the future, is most likely not a valid user. In addition, define the task(s) the users will be performing and how often the task(s) need to be performed.

Empirical measurement:

Test the interface early on with real users who come in contact with the interface on an everyday basis, respectively. Keep in mind that results may be altered if the performance level of the user is not an accurate depiction of the real human-computer interaction. Establish quantitative usability specifics such as: the number of users performing the task(s), the time to complete the task(s), and the number of errors made during the task(s).

Iterative design:

After determining the users, tasks, and empirical measurements to include, perform the following iterative design steps:

- Design the user interface
- Test
- Analyze results
- Repeat

Design methodologies

A number of diverse methodologies outlining techniques for human–computer interaction design have emerged since the rise of the field in the 1980s. Most design methodologies stem from a model for how users, designers, and technical systems interact. Early methodologies, for example, treated users' cognitive processes as predictable and quantifiable and encouraged design practitioners to look to cognitive science results in areas such as memory and attention when designing user interfaces. Modern models tend to focus on a constant feedback and conversation between users, designers, and engineers and push for technical systems to be wrapped around the types of experiences users want to have, rather than wrapping user experience around a completed system.

User-centered design:

User-Centered Design (UCD) is a modern, widely practiced design philosophy rooted in the idea that users must take center-stage in the design of any computer system. Users, designers and technical practitioners work together to articulate the wants, needs and limitations of the user and create a system that addresses these elements. Often, user-centered design projects are informed by ethnographic studies of the environments in which users will be interacting with the system. This practice is similar, but not identical to Participatory Design, which emphasizes the possibility for end-users to contribute actively through shared design sessions and workshops.

Principles of User Interface Design:

Principles of User Interface Design are intended to improve the quality of user interface design. According to Larry Constantine and Lucy Lockwood in their usage-centered design, these principles are:

The structure principle:

Design should organize the user interface purposefully, in meaningful and useful ways based on clear, consistent models that are apparent and recognizable to users, putting related things together and separating unrelated things, differentiating dissimilar things and making similar things resemble one

another. The structure principle is concerned with overall user interface architecture.

The simplicity principle:

The design should make simple, common tasks easy, communicating clearly and simply in the user's own language, and providing good shortcuts that are meaningfully related to longer procedures.

The visibility principle:

The design should make all needed options and materials for a given task visible without distracting the user with extraneous or redundant information. Good designs don't overwhelm users with alternatives or confuse with unneeded information.

The feedback principle:

The design should keep users informed of actions or interpretations, changes of state or condition, and errors or exceptions that are relevant and of interest to the user through clear, concise, and unambiguous language familiar to users.

The tolerance principle:

The design should be flexible and tolerant, reducing the cost of mistakes and misuse by allowing undoing and redoing, while also preventing errors wherever possible by tolerating varied inputs and sequences and by interpreting all reasonable actions.

The reuse principle:

The design should reuse internal and external components and behaviors, maintaining consistency with purpose rather than merely arbitrary consistency, thus reducing the need for users to rethink and remember.

3.1(B) Value Added Service (VAS)

Value-added services (VAS) are unlike core services. They have unique characteristics and they relate to other services in a completely different way. They also provide benefits that core services can not.

The future network will be an integrated network based on IP technology. The integration of data, voice, and multi-media services is not only a challenge for the development of voice service, but also an opportunity. Nowadays, China is under-going a period of rapid growth of voice services both in quality and quantity; meanwhile diversified technique platforms of voice service market and communication carriers make the competition fiercer. How to explore value-added voice business is a task for both fixed network operators and mobile operators.

Interactive Voice Response (IVR) gradually comes out to be the next goldmine for operators and SPs. Its market status of has drawn great attention within the field. Value-added voice service was premiered in Japan and the USA at an early stage, and has now won a remarkable market size, which provides larger space for the development of mobile communication. On all overseas countries that adopt GSM networks, value-added voice service has a bigger business than that of data service. The market size of mobile IVR service in USA reached about 2 billion US dollars last year.

Value-added Service Characteristics:

All VAS share the same characteristics:

1. Not a form of basic service but rather adds value total service offering
2. Stands alone in terms of profitability and/or stimulates incremental demand for core service(s)
3. Can sometimes stand alone operationally
4. Does not cannibalize basic service unless clearly favorable
5. Can be an add-on to basic service, and as such, may be sold at a premium price
6. May provide operational and/or administrative synergy between or among other services – not merely for diversification

3.1(C).a Data-flow in Push and Pull service

Every VAS will demonstrate one or more of the above characteristics. Furthermore, a value-added service will never stand in stark contrast to any of the above characteristics.VAS also have certain time dimensions associated with them. Subjectively speaking, a value-added service today becomes a basic service when it becomes sufficiently common place and widely deployed to no longer provide substantive differentiation on a relative basis.

Relationship to other Services

There are two types of VAS. The first service type are those value-added services that stand alone from an operational perspective. These types of services need not be coupled with other services, but they can be. Many non-voice services fall into this category. They are often provided as an optional service along with voice services, but they could be offered and used by themselves without the voice service. For example, SMS could be offered and used as a service without voice calling.

The second, and arguably more numerous and important type of VAS, are those services that do not stand-alone. Instead, this category adds value to existing services. While it seems implicit in the definition of value-added, this is an important principle that makes value-added services stand apart from other services.

Value-added Services Examples

There are many services that could be considered "value-added". For discussion purposes,

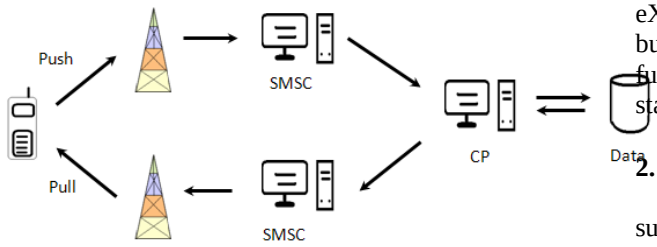
- IVR (Interactive Voice Response)
- PTT(Push To Talk)
- SMS Push-Pull Service
- Call Management

3.1(C) Push & Pull Service

SMS Push is a rapid, efficient and straightforward communications and marketing medium employed to send a few lines of data to end recipient, to the effect of sending information, or reminding of events. SMS Pull is a reliable, mass medium over which users can send triggers for events and services Short messages may be used to provide premium rate services to subscribers of an Operator network. Mobile terminated short messages can be used to deliver digital content

such as news alerts, financial information, logos and ring tones.

- Send SMS (push).
- Read Received SMS (pull)



3.1(D) Interactive Voice Response (IVR)

Interactive voice response (IVR), or IVR, is a technology that allows a computer to detect voice and keypad inputs. IVR technology is used extensively in telecommunications, but is also being introduced into automobile systems for hands free operation. Current deployment in automobiles revolves around Satellite Navigation, audio and mobile phone systems. IVR system can respond with pre-recorded or dynamically generated audio to further direct users on how to proceed. IVR systems can be used to control almost any function where the interface can be broken down into a series of simple menu choices. In telecommunications IVR systems generally scale well to handle large call volumes.

It has become more common in industries that have recently entered the telecom industry to refer to an Automated Attendant as an IVR. This means that when discussing an IVR application, it is important to ensure that the person you are talking to understand the term to mean the same thing as you do. Generally-speaking, those with a traditional telecom background are more likely to refer to an Automated Attendant and IVR as separate things, whereas those from an Emerging Telephony or VoIP background are more likely to use the term IVR to define any kind of telephony menu, even the most basic Automated Attendant.

Typical Use of IVR

IVR systems are typically used to service high call volumes, reduce cost and improve the customer experience. Examples of typical IVR applications are: telephone banking, televoting, and credit card transactions. Large companies use IVR services to extend the business hours of operation. Call centers use IVR systems to identify and segment callers. The ability to identify customers allows the ability to tailor services according to the customer profile. It also allows the option of choosing automated services. Information can be fed to the caller allowing choices such as: wait in the queue, choose an automated service, or request a callback. (At a suitable time and telephone number) The use of CTI(Computer Telephony Integration) will allow the IVR system to look up the CLI (Caller Line Identification) on a network database and identify the caller. This is currently accurate for about 80% of inbound calls. In the cases where CLI is withheld or unavailable, the caller can be asked to identify themselves by other methods such as a PIN or password. The use of DNIS will ensure that the correct application and language is executed by the IVR system.

1. Voice-activated dialers

(VAD) Voice-activated IVR systems are now used to replace the switchboard or PABX (Private Automatic Branch eXchange) operators which are used in many hospitals and large businesses to reduce the caller waiting time. An additional function is the ability to allow external callers to page hospital staff and transfer the inbound call to the paged person.

2. Entertainment and information

The largest installed IVR platforms are used for applications such as voting in TV game shows such as Pop Idol and Big Brother which can generate enormous call spikes. IVRs have also been widely used to take orders for mobile content, such as ringtones and logos, weather forecasts, crossword answers, and the whole spectrum of adult entertainment.

3. Anonymous access

IVR systems also allow callers to obtain data relatively anonymously. Hospitals and Clinics have used IVR systems to allow callers to receive anonymous access to test results. This is information that could easily be handled by a person but the IVR system is used to preserve privacy and avoid potential embarrassment of sensitive information or test results.

4. Clinical trials

IVR systems are used by large pharmaceutical companies to conduct global clinical trials and manage the large volumes of data generated. The caller will respond to questions in their preferred language and their responses will be logged into a database and possibly recorded at the same time to confirm authenticity. Applications include patient randomization and drug supply management.

Technologies used

DTMF signals (entered from the telephone keypad) and natural language speech recognition interpret the caller's response to voice prompts.

Other technologies include the ability to speak complex and dynamic information such as an e-mail, news report or weather information using Text-To-Speech (TTS). TTS is computer generated synthesized speech that is no longer the robotic voice generally associated with computers. Real voices create the speech in tiny fragments that are spliced together (concatenated) before being played to the caller.

An IVR can be utilized in several different ways:

- Equipment installed on the customer premise
- Equipment installed in the PSTN (Public Switched Telephone Network)
- Application service provider (ASP).
- Virtual Hosted IVR

Many business applications employ this technology including telephone banking, order placement, caller identification and routing, balance inquiry, and airline ticket booking.

A simple Voicemail system is different from an IVR in that it is person to person whereas an IVR is person to computer. IVR Voice forms can be used to provide a more complex voicemail experience to the caller. For example, the IVR could ask if the caller wishes to hear, edit, forward or remove a message that was just recorded.

An Automatic Call Distributor (ACD) is often the first point of contact when calling many larger businesses. An ACD uses digital storage devices to play greetings or announcements, but typically routes a caller without prompting for input. An IVR can play announcements and request an input from the caller. This information can be used to route the call to a particular skill set. (A skill set is a function applied to a group of call-center agents with a particular skill)

Interactive voice response can be used to front-end a call center operation by identifying the needs of the caller. Information can be obtained from the caller such as account numbers. Answers to simple questions such as account balances or pre-recorded information can be provided without operator intervention. Account numbers from the IVR are often compared to caller ID data for security reasons and additional IVR responses are required if the caller ID data does not match the account record.

IVR call flows are created in a variety of ways. A traditional IVR depended upon proprietary programming or scripting languages, whereas modern IVR applications are structured similar to WWW pages, using VoiceXML, SALT or T-XML languages. The ability to use XML developed applications allows a Web server to act as an application server, freeing the developer to focus on the call flow. It was widely believed that developers would no longer require specialized programming skills, however this has been proven to be misguided as IVR applications need to understand the human reaction to the application dialogue. This is the difference between a good user experience and IVR hell.

Higher level IVR development tools are available in recent years to further simplify the application development process. A call flow diagram can be drawn with a GUI tool and the application code (VoiceXML or SALT) can be automatically generated. In addition, these tools normally provide extension mechanisms for software integration, such as HTTP interface to web site and Java interface for connecting to a database.

In telecommunications, an audio response unit (ARU) is a device that provides synthesized voice responses to touch-tone keypresses (DTMF) by processing calls based on (a) the call-originator input, (b) information received from a database, and (c) information in the incoming call, such as the time of day.ARUs increase the number of information calls handled and to provide consistent quality in information retrieval.

3.2 SMS Service

In this system following features are implemented through SMS:

- Job Registration
- View Résumé
- Edit Résumé
- Un-register
- Help
- Job Notification
- Apply to job
- View Job Details
- Turn On/Off Notification

An interested client can anytime register to the service through SMS and also deregister from it using the ‘unregister’ keyword. Following a registration, a new account is created corresponding the newly registered client and a ‘personal profile’ is also created with this account. This personal profile is called a “Résumé” and it is saved in the database.

Now if the client wants to view the status of their résumé and/or edit it, they can use the ‘view’ and/or ‘edit’ SMS for it.

Someone can forget the keywords or the process easily, so a ‘help’ service is there. Clients or any individual can use this help service through SMS to know the keywords. When using those keywords an individual starts any of the features, they are completely guided through that process by means of SMS responses. An interaction is build with the users, so they feel comfortable with the manner.

Job-seekers will be notified via SMS instantly when a new job is posted suitable for him. Even they can apply job using SMS. They can immediately apply to that job with a single SMS or choose to view the job-detail first using another SMS. They can also turn the notification service on or off according to their needs.

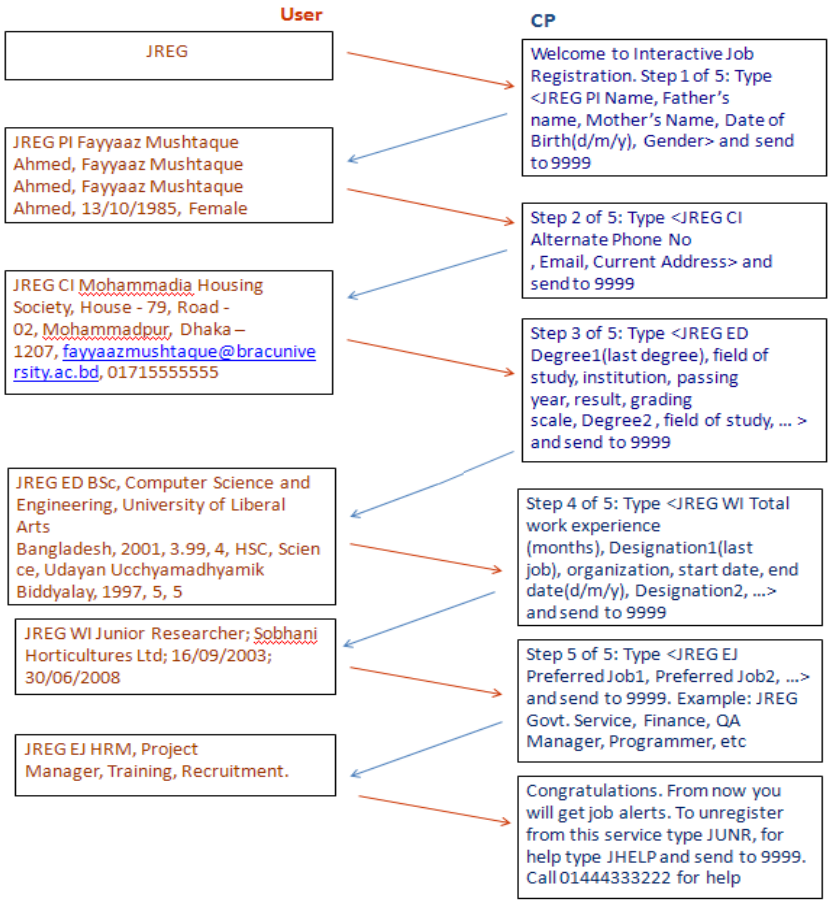
We introduce some keywords to differentiate user’s request. Key words we used are as follows:

- Registration: JREG
- View Job Details: JDET
- Apply to Job: JAPP
- View Job Profile: JVIEW
- Edit Job Profile: JEDIT
- Help: JHELP
- Notification On/Off: JNOT ON/ JNOT OFF
- Unregister: JUNR

A format for writing SMS and sending them has been developed. At each step of registration or other features, the user will be guided as how the text in the message has to be typed and they will be provided with necessary writing format. Expected interactions between users and server for different features demonstrated through sample SMS are following:

3.3.(A) SMS Design: Registration Process

3.3(A) JREG**SMS Service –**



3.3(B) Notifications

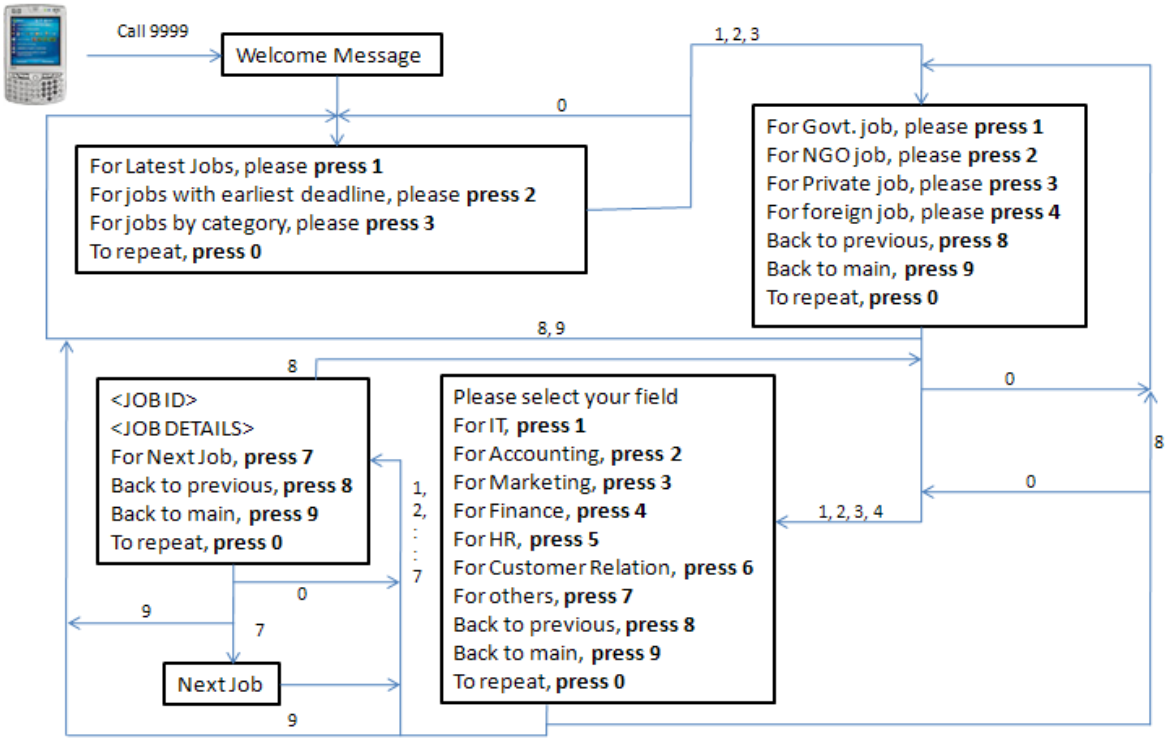
- Users will be notified in following cases:
  - New Job Posted that matches their criteria.
  - Interview alerts: When a job applicant is primarily selected for a particular job, s/he will be notified through an SMS and informed the venue and time. The SMS sent to him/her will be in following format:
  -

> Dear Subscriber, you have an interview alert for <JOB ID xxxxxx>. You are requested to be present at 9:00AM on 15-01-09. Venue: <Company Name>, <Company Address>

3.3.(F) SMS Design: Interview Alert Service

3.4 IVR Service

- IVR service will mainly used for browsing jobs manually and learning about them. It will also tell the way to apply to a particular job through SMS. The illustration below shows how the steps are executed in our IVR system:



3.4.a IVR Design: Browsing Jobs

IV. CONCLUSION

Our main objective was to establish a fresh and apparently complex service with mobile phones so that it can show the way to other service providers to come forward with such services, which will enable a greater part of population, which is outside the reach of the most advanced technologies such as Internet, Satellite Radio, etc but inside mobile network coverage, to access a greater portion of facilities presently unavailable to them.

The hardest part of the project was designing a 'Registration' process only using SMS push and pull. We believe that by designing this process we have succeeded to demonstrate that implementing similar services and procedures is possible, and they only requires some optimization works. We hope to see other service providers will also come with different services and this will contribute in our country's development in various areas such as communication, access to information and business.

REFERENCES

[1] http://www.wikipedia.org/
[2] http://www.computerworld.com/
[3] http://www.cellnumbers.com/cell-phone-usage.aspx
[4] http://www.youra.com/
[5] http://www.banglait.org/WirelessEnvironmentBDout.pdf.
[6] http://www.textually.org

AUTHORS

First Author – Shamim Ahmed, shamim7777@gmail.com, BRAC University, Dhaka, Bangladesh
Second Author – Nur-ul-Arafat, Shomik,nur.ul.arafat@gmail.com, BRAC University, Dhaka, Bangladesh
Third Author – Fayyaaz Mushtaque, Fayyaaz.bu@gmail.com BRAC University, Dhaka, Bangladesh