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Reaching the Masses through a Rural Services Platform

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Abstract—The richness of interaction technologies used by a consumer or moderated by a facilitator for the consumer plays an important role in adoption of financial, advisory and business services by a rural populace. Rural ICT initiatives undertaken so far have focused on device-level technologies that bring in a single service to the consumer. In this paper, we present the architecture and implementation of a *Rural Services Platform* which is not only a low cost shared model, but also brings in innovation in an end-to-end solution while touching the next billion population. We describe our work in the context of social transfers by Government of India like NREGA payments and also present the architecture of a solution which can be used by 1) Business Correspondents who go into the remote villages to disburse payments 2) consumers directly, who can through a voice channel conduct their transactions of money transfers. Our solution can be used to provide an array of services across industries like banking, finance, agriculture, health-care and education to the end user, thereby not only reducing the cost of delivery, but also making the entire innovation scalable.

Keywords-Financial Inclusion, Business Correspondent, Service Delivery.

I. INTRODUCTION

Rural India represents a material opportunity across many categories and the salience is on the increase, driven by a wide range of stimuli. Government's initiatives such as National Rural Employment Guarantee Act (NREGA), higher minimum support prices of crops, farm loan waivers, etc. coupled with factors such as improved irrigation methods and better technology access have all helped people at the "Bottom of the Pyramid". The increasing prosperity of such vast population - approximately 700 million - creates an enticing growth potential. According to a McKinsey study, rural India will have a market worth US\$ 500 - 600 billion by the year 2020.

Despite the vast network of bank branches, only 27% of total farm households are indebted to formal sources, of which one-third also borrow from informal sources. 'Financial Inclusion'¹, as mandated by Reserve Bank of India (RBI), denotes delivery of financial services at an affordable cost to the vast sections of the disadvantaged and low-income groups. To raise financial inclusion beyond current levels and to increase the proportion of social transfers routed via the banking system, banks need to reach out to customers in innovative ways and help lower their cost of customer

acquisition. The BC ("Business Correspondent") model by RBI² becomes the central point of contact between the back-end and the rural consumers, and enables banks to extend banking services to the hinterland without setting up the brick-and-mortar branch. Being a human interface, BC enjoys support of local population and understands their needs and constraints. RBI has laid down standards for technology which will help in communication between the BC network and the bank's core banking systems.

There have been several research efforts to construct delivery models for financial services to rural areas through ICT (Information and Communications Technology), but the results vary in terms of their effectiveness, sustainability and viability. After a thorough study, we concluded that the following key challenges differentiate this part of India³ with the rest:

- **Illiteracy and multi-lingual factor.** A very significant portion of this rural population is either illiterate or semi-literate. The problem is compounded due to the regional diversity with not only every state having a different language but also each region within a state having a different dialect. This implies that the services platform has to be capable of delivering and communicating in the language that the recipient recognizes.

- **Last mile reach and connectivity.** The vast countryside and dispersed population of rural India makes the reach to each individual a major challenge. Moreover, lack of communication infrastructure makes remote connectivity a big issue. In such circumstances, the solution should be able to offer agility of doing transactions offline and then synchronize with the server later. Power situation also is not at its best in these regions, intensifying already aggravated connectivity problem.

- **Socio-economic setting.** The social and economic context of a rural population is vastly different from that in an urban setting. As a result, the nature and extent of services varies from what is required by the urban consumer. More specifically, the set of right offering/services for this segment would be determined by factors such as cash at hand, needs arising due to way-of-living, social requirements, etc. In the

²<http://www.rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=5390>

³Although we focus on India as the primary context, the discussions, problem setting and solution presented in this paper apply generally to any developing economy.

¹<http://rbidocs.rbi.org.in/rdocs/content/docs/IRDGCS170709.ppt>

long-run, usefulness and cost of services would decide their adoption and sustenance.

- **Need for new business models.** For inclusive growth, the solution has to be not only customized but also cost-effective for under-penetrated markets. Call of the hour is ‘frugal innovation’⁴ which integrates specific needs of the bottom of the pyramid market as starting point and work backwards to develop appropriate solution. Existing solutions today require a high initial capital outlay making the entire business model unviable. Key is to have low overall capital cost and enable pay-per-transaction kind of business models.

- **Lack of open standards.** Banks use various different types of hand-held devices to authenticate micro-transactions at the BC location and to integrate the same with bank’s main database. There are no well established open standards for developing and using such devices, which makes usage of diverse equipments a challenge. Similarly, there is no consensus on how to tackle the problem of authenticating each individual, even though government and other private enterprises have been trying to solve this⁵.

There have been various efforts in rural ICT, but those are mainly point solutions offering a single application. In this paper, we take a holistic approach and propose an integrated Rural Services Platform that has one-to-many kind of relationship with respect to various services. This platform provides multiple components to address issues identified above, and seamlessly combines them to enable a government/private enterprise reach diverse rural population while executing any sort of transaction/information exchange. In summary, our contributions can be outlined as:

- 1) A first-of-a-kind Rural Services Platform encapsulating a common services model that can be consumed by several client and device technologies to provide benefits to rural consumers, thereby enabling economic sustenance and easy/quick adoption of new services.
- 2) We describe how our model has uniqueness in terms of handling limited and transient network connectivity prevalent in a rural setting, while efficiently offering support to overcome limited literacy and technical knowledge of consumers.
- 3) We give an implementation of our platform, and depict how it is used to carry out disbursement of NREGA payments to villagers. The same system can be used for providing several financial, educational, health-care benefits to rural consumers.

The rest of the paper is organized as follows. In Section II we describe our Rural Services Platform and its components. Section III provides implementation details of this platform in the context of an application and the hardware and software required to run such a platform. Section IV presents insights gained through discussion with various stakeholders, while Section V discusses some of the related work. Finally, Section VI presents our conclusions.

⁴http://www.yesbank.in/pdf/frugal_innovations.pdf

⁵<http://www.mpf.org.in/pdf/IMG%20Report.pdf>

II. RURAL SERVICES PLATFORM

Figure 1 presents an overview of our Rural Services Platform. It consists of two main portions - (1) client side platform and applications corresponding to various activities of users and business correspondent, as shown in (a), and (2) server side platform taking care of back-end operations, as shown in (b). Below we describe each of these portions in more detail.

A. Client Platform

The client side platform consists of a device middleware, and a set of applications offered to rural consumers, such as banking, micro-finance, health care, etc. The consumers can interact through a variety of devices like kiosks, PoS terminal, netbooks, handheld devices, etc. that are operated by a Business Correspondent. Each of these devices run our device middleware platform that provides a common set of features to applications executing on this middleware. In particular, the *Device Integration* component hides the heterogeneity in API across devices for accessing various device capabilities such as fingerprint reader, printer, etc. On the other hand, the *Device Adaptation* component provides capabilities to transparently adapt an application based on the device. For example, the UI of the application can be transparently adapted to suit the executing device. This makes the application portable across multiple devices.

One important requirement for a rural platform is support for disconnected operations, i.e. no network connectivity, and unreliable power supply. Our client middleware consists of a *Sync Agent* that allows the applications to work in a disconnected mode and then synchronize the data when connectivity is available. Also, since the middleware is available on a host of battery operated devices such as netbooks, handheld devices, etc. it does not require access to continuous and reliable power supply. Further, a *Device Agent* allows remote management of these devices by an administrator such as installing new applications remotely, pushing updates, etc. In case a device is lost or stolen, the data and application can also be remotely wiped-out.

Since villagers can be illiterate or semi-literate, standard authentication mechanisms based on ‘user id’ and ‘password’ would not work. The *Biometric Authentication* component provides capabilities for fingerprint registration and verification that can be used by the applications to authenticate users. It also removes the chances of fraud by a business correspondent, for example, if he happens to know the password of a villager. In case on-line connectivity is available, this component can also use Universal ID (UID)⁶ of a user for authentication. To enable security of data stored on the device, the *Security* component provide ways to encrypt the data, both during storage on the device as well as while synchronizing with the server. This way a business correspondent can not tamper with the data in any manner.

The end-users can interact directly with the back-end system using a variety of techniques such as SMS/USSD, or voice

⁶<http://www.uidacards.com/>

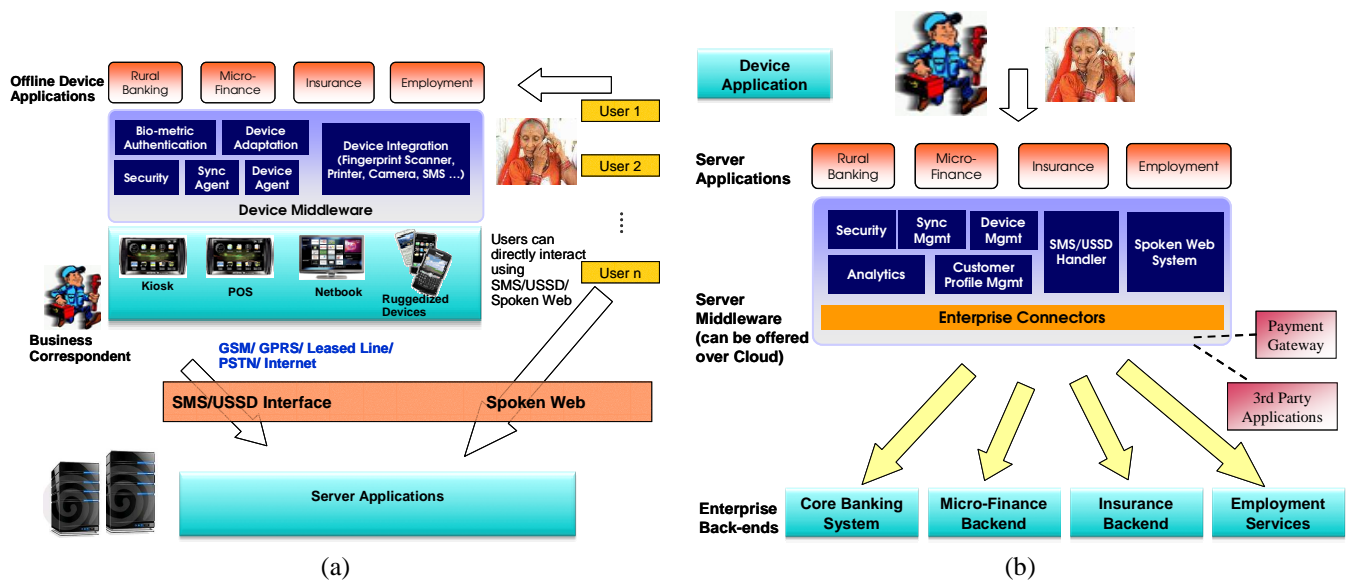


Fig. 1. Rural Services Platform (a) Client Perspective (b) Server Perspective

(Spoken Web [1]) channel. This allows them to directly perform a host of transactions such as balance-inquiry, funds transfer, etc. Also, for each of the transactions performed through business correspondent, the users get an SMS (and/or a Voice call) related to it when the data is synchronized with the server. Through the Spoken Web voice channel, we further enable users to interact and conduct a number of operations/transactions in their *local language* with the system. From the perspective of a business correspondent, voice or SMS channel can be used to fetch real-time customer data from the back-end system whenever on-line connectivity is not available.

B. Server Platform

The server side platform consists of server applications (that support client applications for banking, insurance, etc.), a middleware, and connectors to back-end systems of enterprises that provide services such as Banking, Insurance, etc. Through the use of such connectors, various third party applications can offer their services on the platform. Moreover, there is a payment gateway for villagers to pay for availing different services on the platform. Like the client side, the server middleware provides a set of common features using which a service provider (banking, insurance, etc.) can offer its services to the villagers.

The *Spoken Web* [1] component allows initiation and receiving of voice calls in the local language. Spoken Web is a voice-driven ecosystem parallel and complementary to that of the World Wide Web. It is a network of *VoiceSites* that are voice driven applications created by users themselves and hosted in the network. The *VoiceSites* are identified by global identifiers called *VoiNumbers* and possibly interconnected through *VoiLinks*. Spoken Web has the potential to deliver to underprivileged, what WWW delivers to IT literate users today. More specifically, various service providers on

the platform can create their *VoiceSites* through which they can share information and interact with the illiterate or semi-literate users in their local languages.

The *SMS/USSD handler* component allows functionality for sending and receiving of SMSes and interaction through USSD channel. This component along with the Spoken Web component allows a user to interact directly with the back-end system and perform a host of transactions using a land-line or mobile phone. The *Sync Management* component allows data and transactions from client devices to be synchronized with the server. When the data is synchronized, the corresponding server-side application executes these transactions on the back-end system using enterprise connectors. This process actually completes the transaction and corresponding success or failure is reported to the end-user using SMS or voice channel. The *Security* component enables data to be encrypted before being stored on the server or while transferring to back-end systems.

Certain administrative tasks need to be performed on the devices such as updating applications, installing new applications, locking device, data wipe-out, etc. Since the actual devices are far-off in the villages, it would be prohibitively expensive for a platform owner to manage these devices on-site by sending an administrator. Towards this, the server middleware provides a *Device Management* component that allows an administrator to manage the client devices remotely. Each device has a device agent installed as part of the client middleware. The administrator just needs to send appropriate commands and data to that agent to perform these operations. This significantly reduces the cost of managing the entire system.

The *Customer Management* component allows a common repository of customer profile and data across various services offered through our platform. In essence, a villager should just need to register once with the platform to use any of the offered services. This reduces the overhead of registering



Fig. 2. Business Correspondent Devices

for each individual services and verification of user data. Also, a common user view is provided across services thereby enabling useful analytics to be performed such as product recommendation, cross-sell, up-sell, inferring spending patterns, etc. The *Analytics* component performs such analysis, and would help fine-tune existing offerings as well as launch new ones effectively.

Finally, we advocate the hosting of our server middleware on a Cloud infrastructure that enables dynamic over-the-Internet provisioning of scalable and virtualized resources. This allows the platform provider to optimize its cost initially when the number of services and/or users are few, while supporting scalability as the number of services/users grows. Moreover, this increases the reliability and performance of the entire system.

III. IMPLEMENTATION

We have implemented our platform in the context of the *Mahatma Gandhi National Rural Employment Guarantee Act (NREGA)*⁷ - a rural social welfare scheme launched by Government of India in 2005. Under the provisions of NREGA, every household, whose adult members volunteer to do unskilled manual work, is guaranteed 100 days of wage employment in a financial year. Work allotment as well as payment of wages/ unemployment allowances are done based on a *Job Card* bearing a unique job card number, photograph of all adult members in a household, work record, etc. For receiving payments, accounts of the workers either in the bank or the post offices may be opened by mobilizing the staff of the banks or the post offices at the work-site.

Our Rural Services Platform helps to realize several scenarios related to NREGA, both from a business correspondent perspective as well as a consumer perspective. For business correspondents, we have developed an off-line application that can be installed on two different types of devices (Figure 2) - Netbooks and hand-held ruggedized devices⁸. In particular, for Netbooks we worked with Wipro e.go series that sports a 10 inch wide screen with a weight of 1.25 kilograms, and having Microsoft Windows[®] XP as the operating system. For the

⁷<http://nrega.nic.in>

⁸A ruggedized device is one that is designed to work under adverse environments and usage.

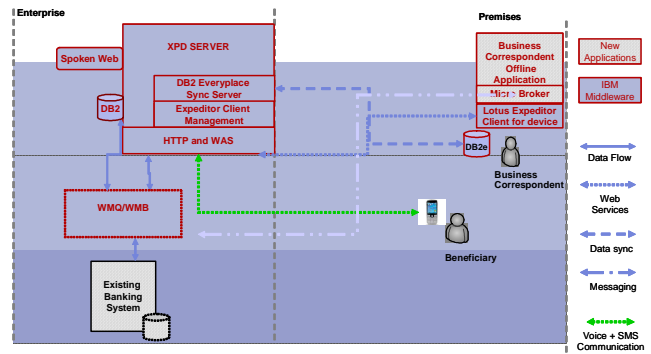


Fig. 3. Implementation Overview

handheld device category, we chose MC70[®] enterprise digital assistant from Motorola running Microsoft Windows[®] Mobile 5.0 for Pocket PC Phone Edition, weighing around 320 grams and having a display diagonal of 3.5 inches. From a financial inclusion perspective, the business correspondents can carry either of these devices to remote locations and conduct various transactions for the consumers. To minimize fraud, both these devices were also augmented with the capability to scan and store finger print information that can be used subsequently for validation. For the Netbook, we made use of the Cross Match[®] Verifier 300 LC (Lexan Case) available with universal serial bus (USB 2.0) connectivity. For Motorola device, we utilized a biometric attachment that provides a FIPS 201 certified fingerprint sensor.

Figure 3 presents an overview of our implemented solution. At the core of this realization is IBM Lotus[®] Expeditor⁹ - an Eclipse¹⁰-based platform for creating, deploying and maintaining both mobile and rich client applications. Lotus Expeditor supports a number of operating environments, including Microsoft Windows, Apple Macintosh, Microsoft Windows Mobile, Linux and more. Applications developed on this platform benefit from a number of desired features we outlined in the previous section - (i) Disconnected access support, whereby applications can be accessed offline through local business logic and data, (ii) Synchronized databases with IBM DB2[®] Everyplace[®], (iii) Server-managed deployment and update of application running on the client, (iv) Security features, including credential (key) store, enterprise single sign-on, local encryption of the Microbroker software, etc. As Figure 3 shows, the Business Correspondent application resides on the Expeditor client for device (Netbook or Motorola MC70). Once transactions have been conducted offline, this application can synchronize with the Expeditor server at the back-end, which in turn is connected to an existing banking system via IBM WebSphere[®] Message Queue.

Figures 4, 5 and 6 presents screen-shots of our application for NREGA disbursements, tailored specifically for Department of Post¹¹, Government of India - in this case, postmen

⁹<http://www-01.ibm.com/software/lotus/products/expeditor/>

¹⁰<http://www.eclipse.org>

¹¹but directly applicable to any bank/institution involved in NREGA payments.

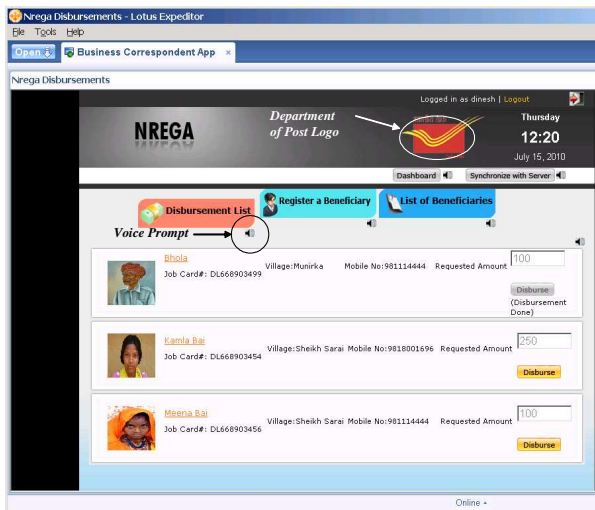


Fig. 4. Disbursement List View

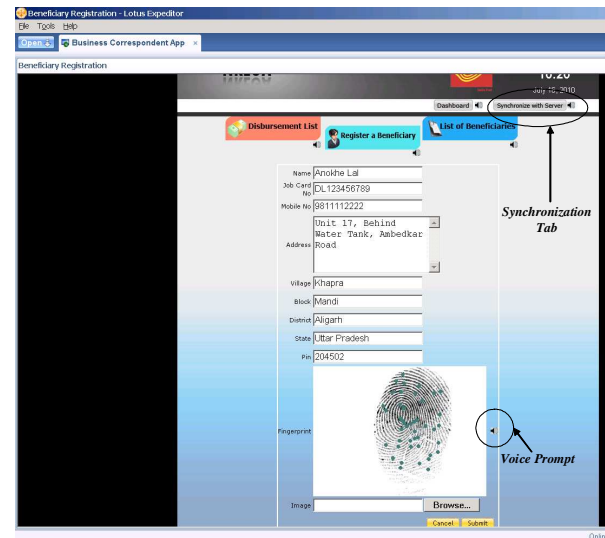


Fig. 6. Beneficiary Registration View

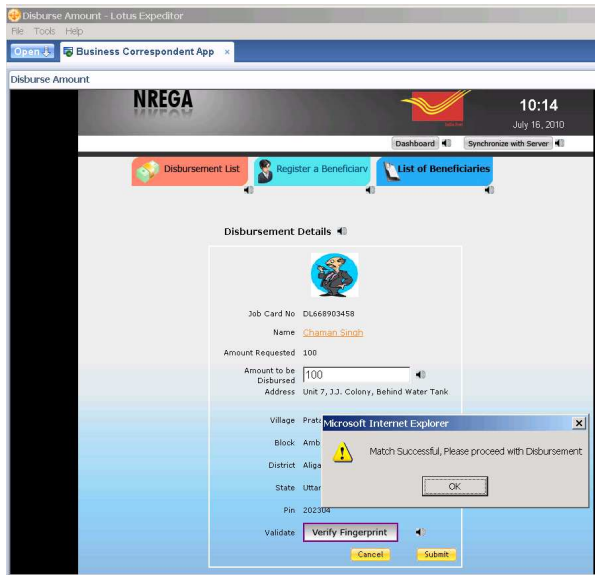


Fig. 5. Amount Disbursement View

would act as business correspondents and distribute money. Overall, there are three broad views available to a postman. The first view (4) provides a *disbursement list*, i.e. a list of beneficiaries who are due to receive money¹² on a particular day; this is also the default view of the application. It should be noted that each beneficiary receives money only after due verification through his/her fingerprint scans (c.f. Figure 5). The second view has the feature to register a new beneficiary, details of which are captured in Figure 6. In essence, through this feature, a worker carrying a valid Job Card can get registered via the postman to avail various services (including opening up of a bank account at the banking back-end) by

¹²Under the guidelines of NREGA, wages are credited to a worker's bank account, from where the worker can subsequently request for withdrawal.

providing details such as job card number, address, fingerprint scans, etc. The third view contains a full list of beneficiaries that fall under the jurisdiction of a particular postman - this can be used by the postman to update details of a beneficiary, make ad-hoc payments, etc. To maintain clarity of reading, we omit the screen-shot for this view. However, mobile screen-shots corresponding to Figures 4, 5 and 6 are captured in Figure 7.

For all actions possible through the application, we provide *voice prompts* to the postman (depicted by 'speaker icons' in the screen-shots). For example, once disbursement has been made to a beneficiary, a voice prompt reminds the postman to get physical receipt signed/ thumb-impressed by the beneficiary. Similarly, if a beneficiary is faltering at the fingerprint verification step, a voice message containing simple instructions on how to place the finger can be played for him/her. Such prompts can be customized in the native language of the region and aid the postman in carrying out various operations smoothly. Finally, the application empowers a postman to synchronize various transactions (conducted throughout the day in an offline manner) with the databases at the server-end. The synchronization could be done, for example, when the postman goes back to the post office at the end of day, or whenever he has connectivity.

We have already emphasized that given the literacy barrier in rural settings, speech is a compelling medium for consumers to interact directly with various services. As mentioned earlier, Spoken Web is a technology that intends users to upload, access, and traverse voice content - all over the regular Telecom channels. We have used this technology to empower rural consumers with a voice interface. Figures 8 and 9 present the overall Spoken Web flow and the funds transfer use case, respectively¹³. As Figure 8 shows, to make use of Spoken Web channel, a consumer first has to authenticate himself/herself

¹³To maintain simplicity, we have omitted finer details of implementation in this paper.

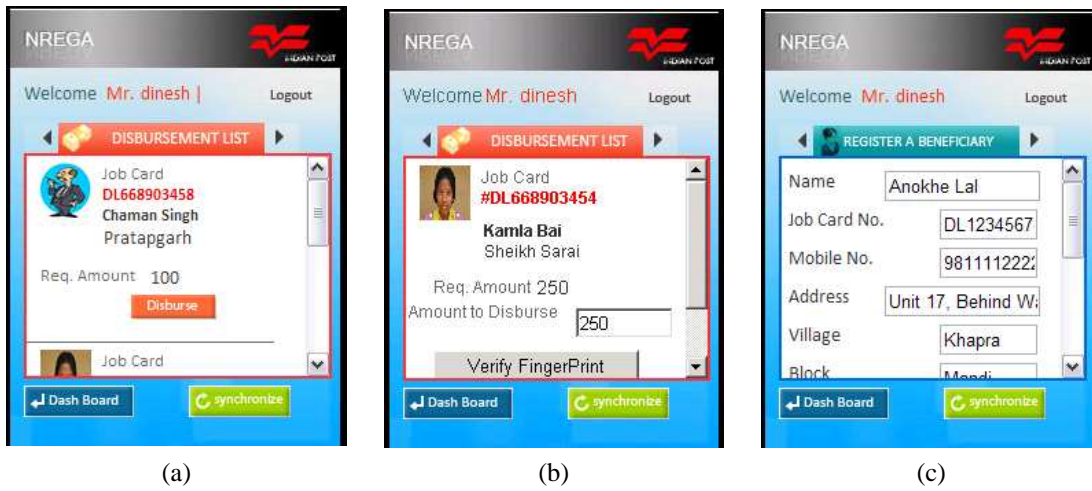


Fig. 7. Mobile Views for (a) Disbursement List (b) Amount Disbursement (c) Beneficiary Registration

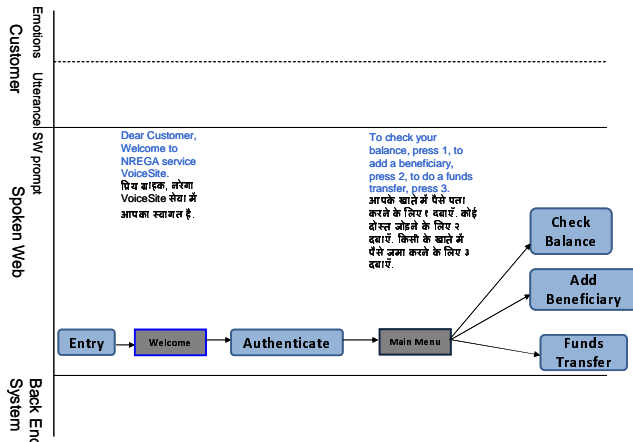


Fig. 8. Spoken Web Flow Diagram

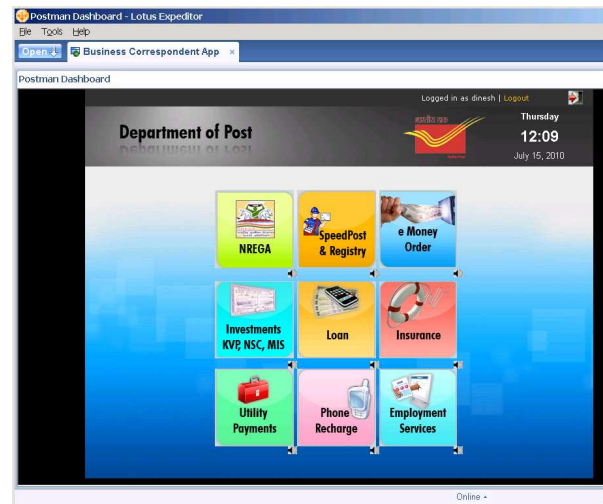


Fig. 10. BC/Postman Dashboard

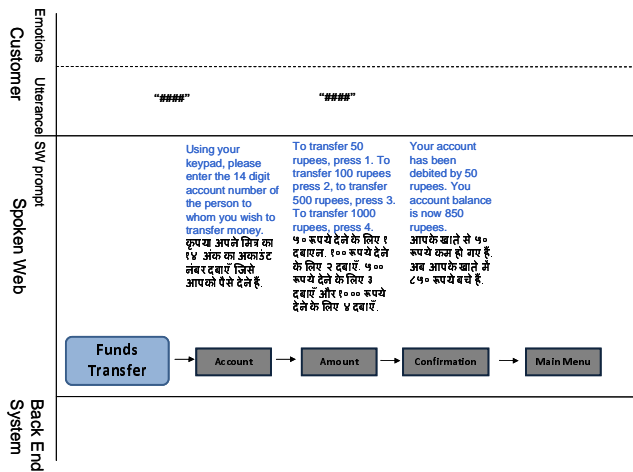


Fig. 9. Funds Transfer

options - (i) checking the balance in his/her bank account, (ii) adding a beneficiary for receiving funds directly from the consumer's account, and (iii) transferring funds to a registered beneficiary. For both registration as well as transferring of funds to a beneficiary, a fourteen digit account number is required. Currently, a consumer can either transfer one of the preconfigured amounts (refer Figure 9) - Indian Rupees 50, 100, 500 or 1000, or specify an arbitrary amount using the phone punch. We are working towards making the voice channel richer, with features such as enabling a consumer to register complaints, provide feedbacks, do a 'voice-shopping', etc.

It must be appreciated that even though the implementation described above was presented with respect to a specific scenario - NREGA, it can be seamlessly utilized by a postman for other services as well. For example, Figure 10 shows a dashboard of various offerings that can be enabled by a postman, such as Speed Post, Money Orders, Investment options from Department of Post, as well as catering to

through questions whose (spoken) answers were provided by the consumer at the time of initial registration. This step also requires the consumer to punch a private 4-digit Spoken Web key. Once authentication is done, the consumer has various

day-to-day needs of the consumers - utility payments, phone recharge, etc. We also emphasize that it is easy to configure our system for use by Business Correspondents related to other enterprises, such as banks, Micro-finance Institutions, and so on. Going forward, we wish to partner with different entities in a rural eco-system and refine our system through relevant deployments.

IV. DISCUSSION

We discussed our Rural Services Platform with several IBM customers and partners, and the response has been interesting and varied. Here, we summarize the initial reactions by some of the clients who are in plans of adopting this platform based on their specific needs and requirements.

- While IBM can provide the technology, the platform itself should be owned by a third party aggregator who would be a neutral body bringing the eco-system partners together. The neutral aggregator would be responsible for business partnerships, contracts between the partners, logistics handshake between the suppliers and demand creators, etc. As per the feedback, this platform has the potential to decrease cost of operations and also to provide monetization opportunity through which various stakeholders in the eco-system earn revenues on each transaction that flows through the platform.
- Clients from the Micro-finance industry have shown positive interest in this platform. One Micro-Finance Institution (MFI) clearly stated that they can use it to support their agents who go deep inside villages where connectivity has been a big hurdle currently. Moreover, they see benefits in being able to remotely wipe data in case the device of an agent is stolen. Another leading MFI mentioned that currently a number of frauds happen due to the emergency loans which can be given by an agent to a Self Help Group (SHG) without requirement of any approvals from the head office. Our platform, through Spoken Web and SMS channels, can easily give the SHG members direct access to the MFIs, without relying too much on the agent.
- Banking sector sees an immediate gain from this platform for their Financial Inclusion efforts. Most of the banking clients do not want to own the new applications and infrastructure, hence, would ideally prefer a hosted cloud model which they can pay for and use as per their requirements. The banks would like this cloud based model to store their customer data which is seen as a “paradigm shift” as traditionally banks have always wanted to store their customer data within their own premises and have been wary of moving to cloud based models. At the same time, banks have also been cautious of using Spoken Web for financial payments purpose as they are unsure about the “risk” implications, but would like to explore further.
- Our discussions with state governments handling NREGA disbursements reveal that the platform can be used for attendance tracking of NREGA workers and also facilitate

in fraud reduction as money dwindling is rampant in the local village bodies.

V. RELATED WORK

The section describes the current work ongoing in this space and tries to highlight advantages of our proposed solution, both technically and operationally.

Enterprises such as Eko Bank [2], Obopay [3], Nokia are trying to build a financial services infrastructure model to increase the reach of financial institutions to the un-banked and to democratize financial services for the un-banked. For example, Eko has tied up with State Bank of India and are leveraging existing neighborhood stores such as chemists, ‘kirana’ shops (local mom-and-pop stores), etc. to open bank accounts for individuals through mobile phones. The transactions are primarily carried out in SMS mode. However, the model in general faces several challenges starting with acquiring agreements with large banks and raising investments to scale up the platform. Moreover, the model is limited to performing financial transactions rather than becoming a generic platform which is a one-stop solution for rural population.

Private Social Enterprises (such as Drishtee [4], SKS [5], Equitas [6], Grameen Koota [7]) focus exclusively on rural India and typically create a network of several hundreds of rural entities to cater to the needs of Bottom-of-the-Pyramid (BoP) market. The enterprise will identify and create a number of ‘milkman routes’ in any given district. For example, in each such route, Drishtee provides a sound kiosk-based platform to deliver services such as Health, Education, Banking, Micro-finance etc. These enterprises also employ field officers who use a paper sheet to mark the attendance, transactions and payments. Later in the day, these sheets are used as source for data entry in the system. Technologically, these social enterprises usually have web-based online management system which is operated through a branch office where power outages are frequent and internet bandwidth is either weak or non-existent. As a result, these enterprises face many hurdles in form of scalability, governance and agility.

Customer Service Centers with independent third party payment solutions (FINO [8], IFMR [9], ALW [10], Sahaj [11] with or without payment gateway such as M-PESA [12], G-Cash [13], ITZ Cash [14] etc.) operate by opening up a Customer Service Center in the rural regions to reach the BoP people. Some of these companies may also provide end-to-end technology and operation solution themselves. They employ a local entrepreneur to act as a single point-of-contact for every transaction requirement. This covers some obstacles as information gap, language, accessibility and standardized infrastructure. Though the entrepreneurs are next-door to the rural citizens, the model involves upfront capital investment in setting up the service center to create the reach for masses, making the model expensive to work for rural users. However, biggest bottlenecks for this model are factors such as internet connectivity, reliability and affordability. Internet connectivity is a key issue in most of rural India. Since most customer service centers rely on online application solutions, this remains

a permanent source of operational challenge.

Work for rural segment has also been proposed and prototyped by various research groups. For example, [15] describes the involvement of digitally skilled users to ensure reach of technology to low-income communities. Similarly [16] presents strategies to lower the cost of providing Automated Teller Machine micro-deposit services in rural contexts. Sherwani et al. [17] have developed a speech based prototype for accessing health information in rural settings. Although important in their own right, these efforts are still point applications that lack the broad intent of our platform.

VI. CONCLUSION

The idea of rural outreach and penetration of the vast population which is still devoid of any formal banking or financial transaction is not new. There has been a lot of related work that has already been carried out but most of this work has been isolated to enable a specific use-case for an "individual" entity. Unique value proposition of what we want to offer is an integrated Rural Services Platform that has one-to-many kind of relationship with respect to various services and can be accessed over multiple channels. This platform can be used by any government/private enterprise to reach to diverse rural population and execute any sort of transaction/information exchange. Although some pieces like analytics are yet to be realized by us, we believe our effort is an important step in harnessing the business opportunities currently locked in this part of the world.

REFERENCES

- [1] A. Kumar, N. Rajput, D. Chakraborty, S. Agarwal, and A. Nanavati, "Voiserv: Creation and Delivery of Converged Services through Voice for Emerging Economies," in *proceedings of 2007 International Symposium on a World of Wireless, Mobile and Multimedia Networks*, June 2007.
- [2] "Eko - Meri Financial Aazadi," <http://eko.co.in/index.php>.
- [3] "Obopay - Money Transfer by Cell Phone, Web or Prepaid Card," <https://www.obopay.com/consumer/Welcome.do>.
- [4] "Drishtee - Connecting Communities Village by Village," <http://www.drishtee.com/cms/>.
- [5] "SKS Microfinance," <http://www.sksindia.com/>.
- [6] "Equitas Micro Finance India P. Ltd." <http://www.equitas.in/>.
- [7] "Grameen Financial Services Pvt. Ltd." <http://www.gfspl.in/>.
- [8] "Financial Information Network & Operations Ltd. (FINO)," <http://www.fino.co.in/index.aspx>.
- [9] "IFMR-Centre for Micro Finance," <http://www.ifmr.ac.in/cmfi/>.
- [10] "A Little World," <http://www.alittleworld.com/>.
- [11] "Srei Sahaj," <http://www.sahajcorporate.com/>.
- [12] "M-PESA," <http://www.safaricom.co.ke/index.php?id=745>.
- [13] "G-Cash," www.g-cash.com.ph/.
- [14] "Itz Cash Card Ltd." <http://www.itzcash.com/>.
- [15] N. Sambasivan, E. Cutrell, K. Toyama, and B. Nardi, "Intermediated Technology Use in Developing Communities," in *CHI '10: Proceedings of the 28th International Conference on Human Factors in Computing Systems*.
- [16] M. Paik and L. Subramanian, "ATMosphere: A System for ATM Microdeposit Services in Rural Contexts," in *ICTD'09: Proceedings of the 3rd International Conference on Information and Communication Technologies and Development*.
- [17] J. Sherwani, N. Ali, S. Mirza, A. Fatma, Y. Memon, M. Karim, R. Tongia, and R. Rosenfeld, "HealthLine: Speech-based Access to Health Information by Low-literate Users," in *ICTD'07: Proceedings of the 3rd International Conference on Information and Communication Technologies and Development*.