

'INNOVATIVE USE OF MOBILE TECHNOLOGY IN e- GOVERNANCE'

Name of the Project: mSwasthya

1. Coverage – Geographical and Demographic:-

(i) Comprehensiveness of reach of delivery centers

The mSwasthya health, wellness and fitness app store is an online solution so the delivery centers are not location specific. Any user can download these apps on their Smartphone's. All the apps are freely downloadable so the user can download the installation file directly on their mobile device.

(ii) Number of delivery centers

mSwasthya apps are available online so users can manually install in it or can download it online if user has internet connectivity on their mobile device. To provide different options for app downloads the mSwasthya apps are available through three online app stores. These are: mGov store, mSwasthya app store and Google Play app store.

(iii) Geographical

mSwasthya targets users from all sections social or economic of the society which also covers all age groups from children, women, young and elderly peoples. mSwasthya health, wellness and fitness apps are deployed on stores such as: mGov store, mSwasthya app store and Google Play. So accessibility of apps is independent of geographical limitations.

(a) National level – Number of State covered

mSwasthya health, wellness and fitness app store is an online solution which has a national level prospective for all users of Smartphone and non- Smartphone, which specifies that the user who believes in preventive health care can utilize any app for its individual use. Thus the solution provided is independent from any geographic dependency and covers all states of India.

(b) State/UT level- Number of District covered

mSwasthya health, wellness and fitness app store is an online solution which has a national level prospective for all users of Smartphone and non- Smartphone, which specifies that the user who believes in preventive health care can utilize

any app for its individual use. Thus the solution provided is independent from any geographic dependency and covers all districts of India.

(c) District level- Number of Blocks covered

The solution provided is independent from any geographic dependency and covers all cities of India.

(iv) Demographic spread (percentage of population covered)

All the apps are available free of cost to the citizen of India. The apps published on mgov store, Google play and mSwasthya app store covers all mobile users. Till date there are 7000+ downloads of apps published on mgov store.

2. Situation before the Initiative (Bottlenecks, Challenges, constraints etc with specific details as to what triggered the Organization to conceptualize this project):

With coming of new age technologies and with increasing health 'sensitization' amongst people, a need was felt to have a mechanism for promoting 'self-care' to overcome the healthcare infrastructural challenge. Moreover, the citizens in India have the tendency to visit healthcare delivery institutions only at the time of ailments/ distress. This puts a burden on the healthcare infrastructure, which is still grappling with the increasing population. Also, with advancements in technology, mobility is no longer seen as a limitation and the fact that India has a deep mobile penetration, the mobile device is seen as an empowering tool for enabling healthcare.

Considering all of this, 'mSwasthya' was designed to enable the holistic healthcare approach of the people to move away from curative care and strengthen their belief towards preventive care. It encourages 'self-care' as any health maintenance activity of an individual, family or community, with the intention of improving or restoring health, or treating or preventing disease. mSwasthya brings with it various citizen-oriented mobile apps for 'self-care'. Hence, mSwasthya aims to bring about a behavioral change amongst all the citizens to shift from curative care to preventive care.

mSwasthya, is a first-of-its-kind healthcare app store that provides mobile apps on health, wellness and fitness encouraging people to take up a healthy lifestyle. The 20+ mobile apps are designed as citizen-oriented and can be used to improve their own health and well-being. This has led to the triggering of actions and attitudes contributing to the maintenance of well-being and personal health and thereby promoting human

development. Hence, the focus was observed to be gradually shifting from curative care to preventive care.

Challenges faced before deployment of the project

i. Identifying the medium of communication:

The various apps deployed under mSwasthya app store sends SMS to its users, all such SMS are triggered depending on the situation (like when a user registers using any of the mobile app, or when auto generated notification SMS alerts sent by the system needed to be triggered). With Do-Not-Disturb (DND) service, it was felt to have a SMS service which would deliver messages to the users irrespective of their DND status. And to make it sustaining and a free service for all, was a challenge.

So, the solution was to integrate SMS based API's, which do not deduct SMS cost by the service provider of the users. Initially a free third party SMS gateway service was implemented which had a limitation to number of SMS sent per day. Thus a permanent solution was felt considering many of the apps deployed generates auto-alerts for certain services.

The solution to this problem was resolved by using the SMS services as part of the India's SMS Gateway i.e. mGov Mobile Seva service. The service involves creating an account on mGov portal with details of service for which the SMS facility was used, thus a Sender ID was specified for health services that was used while sending SMS on user's mobile number. CDAC Mohali has chosen the sender ID 'CDACMH'. Initially Push SMS service was implemented and users using Consult-a-doc, Diabetes Monitor, BP monitor and other apps get alerts in the form of SMS in case of any medical emergency; in vaccination alerts, SMS are sent to notify parents about the upcoming vaccination date of the child and all users of all other apps also gets SMS notification on successful registration. The users who do not have a smart phone but interested in getting their child registered for mSwasthya vaccination alert app, a solution based on Pull SMS service is also implemented.

ii. To enable the availability of apps to all the Citizens:

Being a Government of India initiative, the need was felt to extend the various applications developed to all the citizens of India. The challenge was to have a platform, which would facilitate the download of all the apps developed under mSwasthya, and also ensure that the platform doesn't have any recurring charges for long-term sustainability.

So, for this, discussions were held with mGov mobile app store team and took approval for the launching of all the apps on the mGov store along with mSwasthya app store.

So, all the apps are now freely downloadable from both app stores. Users can download the installation file either directly on their mobile device or can install it manually by copying the app files to their mobile devices. Also, for deeper penetration of mSwasthya apps, these were published on the Google Play Store.

iii. Enabling a Cross Platform Environment:

With varied Operating Systems and browsers being used by different users, a common approach was required to cater to all the users and not restrict it to a certain section of users. Thus the idea was to develop more consistent user interfaces for the apps which do not dependent upon the device from which they are accessed. Thus, we need to target and design apps considering various devices like smart phones and tablet devices. The technology is changing rapidly and thus the way of interaction has also changed. The web portal has also been developed in such a way, that it could be accessible on mobile browsers, laptops and desktops browsers. Thus, with the use of HTML5 technology, www.mSwasthya.in is designed to be accessible on various range of devices.

iv. Problem analyzing the user needs:

To put everything in a mobile app according to the apps requirement was another point of concern. To provide a generalize view of basic features could be done from abstracting the data submitted by the real time testing, but important changes are all dependent upon user feedback, so a mail id for user feedbacks is also specified.

v. Security of the system:

Having the concern that the users would be sharing and storing their personal health and clinical details on mSwasthya, it was imperative to have a strong and robust system with all security measures plugged in. mSwasthya is well designed because more and more user information is being integrated with the expansion of services and applications, and also to verify data integrity and access control. Thus major encryption algorithms are written with MD5 based encryption. The threat for scripting of auto generated attacks for login is always there, so CAPTCHA is provisioned to ensure that the user is human. A two-step SMS based registration process is adopted to authenticate all users.

3. Scope of Services (Relevance of application for e-governance, Extent to which service is delivered through mobile #)

There are 20+ mobile apps are designed as citizen-oriented and can be used to improve their own health and well-being. This has led to the triggering of actions and attitudes contributing to the maintenance of well-being and personal health and thereby promoting human development. The mSwasthya apps are developed to upgrade the health awareness among users, as well as promote the preventive health care among them. mSwasthya targets users from all sections social or economic of the society which also covers all age groups from children, women, young and elderly people.

Smartphone Users: All the users who have a smart phone can easily download app on their mobile and can start using it. They can download apps from any of the app store i.e. mgov.mobile app store, Google Play Store and mSwasthya app store.

Non-Smartphone Users: There are apps designed for non-smartphones asers also like Child Immunization Alert System (CIAS) is a mobile app that alerts over SMS, emails, and push notifications to the parents, having children up to the age of 5 years, as recommended by India's Ministry of Health and Family Welfare. Parents can view the upcoming vaccinations and know about their benefits. In case of non-smartphone users, they may type PB Health DDMMYYYY of the child and may send SMS to 51969. This will ensure that their child would be registered with mSwasthya portal and system would automatically start sending Alert SMS on the registered mobile number.

4. Strategy Adopted

(i) The details of base line study done

With coming of new age technologies and with increasing health 'sensitization' amongst people, a need was felt to have a mechanism for promoting 'self-care' to overcome the healthcare infrastructural challenge. Moreover, the citizens in India have the tendency to visit healthcare delivery institutions only at the time of ailments/ distress. This puts a burden on the healthcare infrastructure, which is still grappling with the increasing population.

(ii) Problems identified

The citizens in India have the tendency to visit healthcare delivery institutions only at the time of ailments/ distress. This puts a burden on the healthcare infrastructure, which is still grappling with the increasing population. They are more towards curative care rather than preventive care. mSwasthya' encourages 'self-care' as any health maintenance activity of an individual, family or community, with the intention of improving or restoring health, or treating or

preventing disease. mSwasthya brings with it various citizen-oriented mobile apps for 'self-care'.

Moreover, People were also very well versed with technology. So to make people aware about the use of technology for their health care and well being is key focus of mSwasthya.

(iii) **Roll out/implementation model**

mSwasthya is a healthcare mobile app store, which consist of various mobile apps to promote 'self-care' among Indian citizens. There are various mobile apps on health, wellness and fitness which have been designed under the mSwasthya umbrella. The users can select any of the apps which suits his/ her health, wellness and fitness needs, download it free-of-cost and begin accessing the applications. A one-time registration is done to access these apps. The registration could be done either at the web (URL: www.mSwasthya.in) or from any installed mSwasthya mobile app.

The mSwasthya architecture consists of following components:

1. User Interface Design: While development of products for the end users, we have deployed the solutions with improved and easy to understand User Interface with a idea to improve apps usability which remains an important factor. All Solutions designed in mSwasthya have been implemented to work on respective devices independently from the screen sizes or hardware issues. Thus native apps could be installed on tablets or mobiles with presence of operating system which the apps store like: android, whereas browser based solutions www.mSwasthya.in is also independent from the hardware or screens sizes of the devices on which it could be accessed as: laptop, PC, tablet or mobile.

2. Authentication and accesses control: The authentication system for mSwasthya is well designed with MD5 based encryption, MD5 has been utilized in a wide variety of cryptographic applications, and is also commonly used to verify data integrity and accesses control is also done with captcha based login checks. This authentication solution is well structured in accordance with the web services which are used for all data integration with one and other apps for a synchronized data exchange. So, all users of the apps needs to complete a login check for integration of information and personal health record based data exchange with other services. SMS based one-time registration verification code is user to authenticate users which could avoid the overhead of continuous

scripting attacks. Email/SMS alerts are sent with change of information or retrieval of passwords by the users, with maintenance of user login activities.

3. Web services: A Web service is a method of communication between two electronic devices over a network. It is a software function provided at a network address over the web with the service always on as in the concept of utility computing. Thus all the data deployed of cloud based system so a proper synchronized web service related structure is done, the web services are used for all cross platform data exchange of user data from their device to the centralized data servers with proper authentication checks. The web services are deployed to provide all user management services, app routing services, configurable alert mechanism with communication services for sending push notifications, emails, SMS.

4. Data Storage: The cloud computing based central data servers are used as the major storage solution for mSwasthya data exchange. These servers are well maintained for real time data exchange of information using various mSwasthya web-services.

(iv) **Communication and dissemination strategy and approach used**

The health, wellness and fitness related mSwasthya apps are designed for mobile devices so all the resources which are available on a device for internet connectivity are considered which includes the communication services like: GPRS, 2G/3G services provided by the service provider, WiFi communication channel available on the device. Once the apps are connected to internet using any of the communication service, further the installed apps uses secured web-services for sending and receiving users personal health record data. The information dissemination happens in two modes:

Offline mode: In this mode users can download apps own their mobile device and can start using the apps. Internet connectivity is not required as database of apps is maintained locally.

Online mode: Once the user has installed app on his/her mobile device, there are two options provided to the user; user chooses sign up option if wants data of his app to be shared with mSwasthya portal and in that case internet connectivity is required. If user is interested to keep his data locally in mobile then

5. Technology Platform used

(i) Description

The integrated development environment and technologies used for development of mobile apps which are deployed on: mGov app store, www.mswasthya.in and google play store is as follows:

- Product design and development is done using Eclipse and Android Studio as IDE
- Technology used for development is based on Android SDK (2.3 and above).
- XML based web services for integration of applications with the data storage servers.
- Emulators based testing of developed apps.
- SQLite is used for storage of data on mobile devices.

The integrated development environment and technologies used for development of web portal URL: www.mswasthya.in is as follows:

- Product design and development is done using Visual Studio 2008 on .Net Framework (3.5).
- Technologies used include asp.Net 3.5 with C#, LinQ, JQuery, Json, XML Web Services, Ajax, HTML/CSS, HTML5/CSS3, and Javascript.
- MSSQL Server 2008 is used for storage and retrieval of data.

(ii) Interoperability

The mSwasthya apps communicate with the server using web services. These web services can be accessed through any device or operating system. There is no dependency on platform for the consumer of these services. Some of the features in terms of interoperability of solution implemented are given below:

Opening up of Web APIs: mSwasthya would not just be a web portal or app store. It would be much more beyond that, the basic ideology for development is same as providing more improved healthcare solutions on user devices. Our future focus is to release own application programming interface (API) which specifies how some software components should interact with each other. Such API's will thus provide a platform for developers are working in healthcare domain for using these API's according to their system to develop more and more innovative mSwasthya apps. The personal medical record data will be made available to certain authenticated third party applications to allow development of more health care apps.cross browser corss platform.

Different Mobile Platforms: mSwasthya will be expanded with more apps on the different self-care based health services apps. Presently app development is done in android only and to some extent windows phone platforms. Once the group of apps been successfully covers the majority of users on a single platform futures platforms will be added accordingly, till now apps are developed and deployed by utilizing the open source platform to its extents, further these apps will be launched in iOS and Windows mobile platforms.

(iii) Security concerns

Having the concern that the users would be sharing and storing their personal health and clinical details on mSwasthya, it was imperative to have a strong and robust system with all security measures plugged in. mSwasthya is well designed because more and more user information is being integrated with the expansion of services and applications, and also to verify data integrity and access control. It includes theses security concerns:

- Thus major encryption algorithms are written with MD5 based encryption.
- The threat for scripting of auto generated attacks for login is always there, so CAPTCHA is provisioned to ensure that the user is human.
- A two-step SMS based registration process is adopted to authenticate all users.
- All login activities are maintained with proper logs.

(iv) Any issue with the technology used

All of the mSwasthya apps are developed in Android platform which is an open source environment. And to initiate the development in open platform learning curve involved as team first learned the technology by their self. There are no issues being faced regarding the current technologies being used. The android platform is open source and to increase the user base the iOS and windows apps will be launched soon.

(v) Service level Agreements (SLAs) (Give details about presence of SLA, whether documented, whether referred etc. #)

All mobile apps are deployed on: mGov app store and google play store. mGov app store is an eGovernance service to deploy mobile based applications on government app stores, these services enables mSwasthya to have a large base of end users. Both mgov and google play store are responsible for managing servers and providing continuous service of the users.

6. Citizen Centricity (Give specific details on the following#)

(i) **Impact on effort, time and cost incurred by user**

mSwasthya has been funded by the Ministry of Communications and Information Technology, Government of India. The various applications which are been developed out of this project have been made available to the people at large free-of-cost. In order to make a long lasting and sustainable, a sincere effort has been made to integrate various readily available mGovernance services provisioned by the Government of India.

(ii) **Feedback/grievance redressal mechanism**

For Feedback/grievance redressal email Id and contact number is specified with each app. Users can query, give their feedback or can contact respective mobile app's support team. The details of email Id and contact number are given below:

EmailID-info@mswasthya.in

Contact Number 0172-6619059

(iii) **Audit Trails**

mSwasthya has been funded by the Ministry of Communications and Information Technology, Government of India . Department of electronics and information technology (DeitY) Ministry of Communications and Information Technology, Government of India has set up a committee i.e. Project Review and Steering Group (PRSG). PRSG keeps the periodical reviews of the project.

(iv) **Interactive platform for service delivery**

The process of mSwasthya apps deployment is well designed service platform. The users don't require to depend or to reach any service delivery center all apps are downloaded and installed on the mobile devices with supported operating system. The apps could be accessed from any of the service delivery platform which includes mGov app store: <https://apps.mgov.gov.in>, mSwasthya app store: www.mswasthya.in and Google play store.

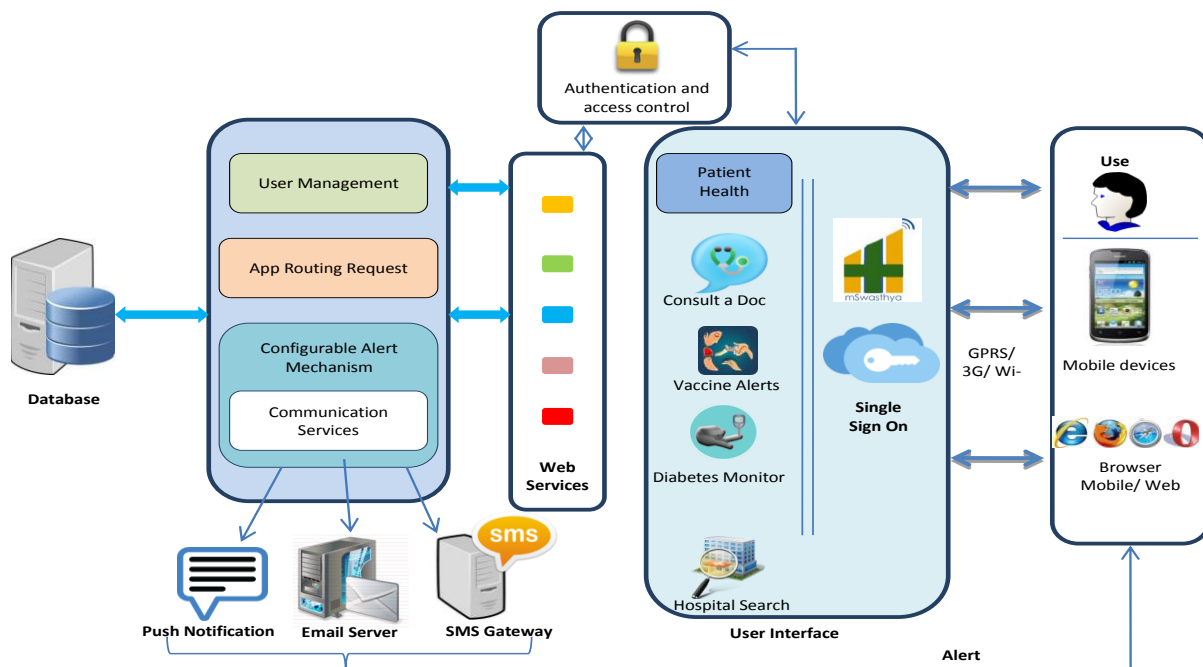
(v) **Stakeholder consultation**

The health parameters are designed in consultation with specialists from Post Graduate Institute of Medical Education & Research (PGIMER). Doctors with specialization in different domains have given their expert advice for designing the apps on healthcare data. User manages his profile by his own.

7. Demonstrate Innovation in use of Mobile Technology for e-governance (Give details about the mobile technology used (platforms, SMS, Pull & Push, Apps, Mobile Payment), innovation applied in use of mobile technology to deliver information or Services to target audience #)

mSwasthya is a healthcare mobile app store, which consist of various mobile apps to promote 'self-care' among Indian citizens. There are various mobile apps on health, wellness and fitness which have been designed under the mSwasthya umbrella. The users can select any of the apps which suits his/ her health, wellness and fitness needs, download it free-of-cost and begin accessing the applications. A one-time registration is done to access these apps. The registration could be done either at the web (URL: www.mSwasthya.in) or from any installed mSwasthya mobile app.

The figure below shows the architecture of mSwasthya solution:



The mobile apps are developed in Android platform. Android is open source and most popular mobile OS today. The android mobile phones' are making a deeper penetration in the Indian smartphone market. Almost all apps in mSwasthya provide the data notifications or alerts to the users through SMS, emails, and push notifications to the user.

The architectural details of mSwasthya must have provided a detailed description of mSwasthya as a personal health care solution. mSwasthya is also a repository of the Personal Health Records (PHRs) of users which aggregates data from the various health apps installed by the users on their respective devices. It provides an integrated approach for the central storage and access of all health records of users under mSwasthya. This integration enables users to generate personal health record using a single login id, which could be used for over 20+ mobile apps designed under mSwasthya. All apps are specifically designed and promoted for 'self-care' related to health, wellness and fitness targeting the young, the elderly, women and children. Each app has its own set of users in which apps like Nutrition Facts, Calorie Counter, Walking, Cycling and Fitness Track targets the young users and also the elderly once who consider that self-care is important for better health. The apps like Child Immunization Alert System (CIAS) removes the overhead of remembering dates of immunization of child registered and could get time based automatic alerts, as well as Medicine Monitor improves the way medicine prescription is to be taken care, now the user once configures an alert time for medicine the app will generate alerts on the configured time, by making it time bound and hassle free solution.

8. Adaptability and Scalability (Give details about Local language support, ability to leverage shared Government infrastructure, Standardization of technology used (hardware, software, application etc. #)

Ability to leverage shared Government infrastructure

The **Mobile Seva - eGovernance initiative for SMS services API** is being used to provide data to users through SMS without incurring any charges to the user.

Mobile Seva - eGovernance initiative for SMS services

To make a free SMS service for all users was a development challenge so the solution needs to integrate SMS based API's which would not deduct SMS cost by the service provider of the users. Initially we implemented the free third party SMS gateway service which is limited to number of SMS sent per day. Thus a major solution is needed as many of the apps deployed generate auto alerts for certain services. The solution to this problem is resolved by using the SMS services developed by CDAC Mumbai i.e. mgov mobile seva service. The service involves creating an account on mgov portal with details of service for which we would use the SMS facility, thus a Sender ID was

specified for state health services that would be used while sending SMS on user's mobile number. CDAC Mohali has chosen the sender ID 'CDACMH' where MH stands for mobile health. Initially Push SMS service was implemented and users using Diabetes Monitor, BP monitor and Feel safe gets alert in the form of SMS in case of any medical emergency; in vaccination alerts SMS are sent to notify parents about the upcoming vaccination date of the child and all users of all other apps also gets SMS notification on successful registration. The users who do not have a smart phone but interested in getting their child registered for mSwasthya vaccination alert app, a solution based on Pull SMS service is also implemented.

Integration with mGov App Store- web based services

All the apps which are developed for mSwasthya app store are also deployed on mGov app store; an eGovernance service to deploy mobile based applications on government app stores, these services enables mSwasthya to have a large base of end users.

UID based integration:

Aadhaar is a 12 digit individual identification number issued by the Unique Identification Authority of India on behalf of the Government of India. This number will serve as a proof of identity and address, anywhere in India. We are in a process to integrate mSwasthya apps with such unique feature currently mSwasthya Child immunization app is designed to store UID information of the user so that proper authorization of users could be done. Thus the usability of such apps will help us to identify how future updates will be integrated with UID based solutions.

Standardization of technology used (hardware, software, application)

The mobile apps are developed in Android platform. Android is open source and most popular mobile OS today. The android mobile phones' are making a deeper penetration in the Indian Smartphone market. Software Standardization are upward compatibility i.e. a mobile app is developed in the earlier version of Android is compatible with the latest version of the Android mobile application development platform. In terms of Application Standardization, mswasthya web portal is a browser independent can be accessed in all browsers.

9. Adaptability Analysis

(i) Measures to ensure adaptability and scalability

The Adaptable Software thrust consists of many projects. Each of these projects strives to investigate and develop systems that change their behavior over time

due to some stimulation by or interaction with the environment. The solution by mSwasthya has a adaptable change for the users which helps them decide which application suits their major need to store PHR data. The system is well designed and developed to work accordance with the future changes including algorithm as well as user parameters changes. The data we retrieve from all mSwasthya applications can be adaptable for future health policy makers, the kind of PHR helps to identify the life style changes of individuals. The project has a scalable approach to build a great repository of PHR data and solutions for real users.

(ii) Measures to ensure replicability

mSwasthya will be expanded with more apps on the different self-care based health services apps. Presently app development is done in android only and to some extent windows phone platforms. Once the group of apps been successfully covers the majority of users on a single platform futures platforms will be added accordingly, till now apps are developed and deployed by utilizing the open source platform to its extents, further these apps will be launched in iOS and Windows mobile platforms.

(iii) Restrictions, if any, in replication and or scalability

Restriction is not applicable as such but for accessing all the features of each app Smartphone would be requirement.

(iv) Risk Analysis

mSwasthya is a Health, wellness and fitness app store that consists health sensitive data of individuals. So, security measures are applied to keep the privacy of the user.

10. New Models of Service Delivery (Give details about type of partnership model used, Links to/Supported by Public/Private Organization, Links provided to relevant websites etc. #)

Supported by Public Organization

Mobile governance (m-governance) aims to leverage wireless and new media technology platforms, mobile devices and applications for delivery of public information and services to all citizens and businesses. It aims at widening the reach of, and access to, public services to all citizens in the country, especially in the rural areas

by exploiting the much greater penetration of mobile phones in the country. It also leverages the innovative potential of mobile applications in providing public services. The overall strategy aims at making India a world leader in harnessing the potential of mobile governance for inclusive development. The initiative has been conceptualized and formulated by the Department of Electronics and Information Technology (DeitY), Government of India. Centre for Development of Advanced Computing (C-DAC), a DeitY organization, is the technical implementing agency for the project.

mgov.gov.in

Supported by Private Organization

Google Play Store serves as the official app store for the Android operating system, allowing users to browse and download applications published on Play Store. mSwasthya account has been created on Google for publishing the apps on Play Store.

play.google.com

11. Efficiency Enhancement (Give specific details about the following #)

(i) Volume of transactions processed

All the apps are deployed on mgov portal, Google Play Store and mSwasthya app store. Till date there is 10000+ downloads of all apps

(ii) Coping with transaction volume growth

mSwasthya portal is deployed on a Cloud based server. Google manages downloads and updates of apps published on Google Play store by their own Cloud servers. Cloud enable server has load bearing capacity which balances and manage online traffic by distributing workloads across multiple servers and resources automatically or on demand. They maximize workload performance and help prevent overload to help give users a seamless experience.

(iii) Time taken to process transactions

Time taken to process the transactions depend on the type of the internet connectivity users have whether it's 2G/3G, wifi etc and size of mobile app. Time taken is proportionate to both the size of mobile app and bandwidth available. The size of mobile apps is in kilobytes (KB) and maximum size of mSwasthya mobile app is of 4 MB so it can be easily downloaded on user's mobile with minimum bandwidth.

(iv) Accuracy of output

All the health parameters are designed in consultation with PGIMER doctors to ensure the accurate results. Moreover, various available authentic health portals, journals and health magazines and papers were also explored.

(v) Number of delays in service delivery

All Apps are available round the clock so delay is not applicable.

12. User convenience (Give specific details about the followings #)

(i) Service delivery channels (Web, email, SMS etc.)

There are various service delivery channels that have been accepted in mSwasthya health, wellness and fitness app store. All the apps can be downloaded/ installed in mobile devices and can also be accessed on web i.e. www.mswasthya.in, <https://apps.mgov.gov.in>, <https://play.google.com>

mSwasthya has a base for apps with auto-generated SMS functionalities as one of the important service channel, various apps deployed under mSwasthya app store sends the SMS or Email to its users, such SMS's are triggered depending on the situation like when a user registers using any of the mobile app, or when auto generated SMS alert is to be triggered. So to enable such services we have incorporated various e-Governance solutions available in CDAC. All the services delivery channels accepted within mSwasthya are completely associated with the eGovernance service available at CDAC.

Push notification is another medium of sending information to the user which uses Google Cloud Messaging for Android (GCM) is a service that allows you to send data from your server to your users' Android-powered device, and also to receive messages from devices on the same connection. Whenever a user

downloads an app on his mobile device, device is first registered on mSwasthya portal and then that information is sent Google Cloud Messaging Server. So that GCM service can use the registered device ID for sending Push Notifications.

(ii) Completeness of information provided to the users

mSwasthya data storage system is well designed to process all the personal health records of individual users. The Personal Health Record (PHR) is processed to give the users all details about their activity logs and services used by them. Comprehensive PHR enables better living and healthier lifestyle. Apps are reviewed and updates are made on a continuous basis. Hence the revised versions of apps are updated on the all three app stores. Users can download the recent version of apps which would automatically be updated keeping the existing data intact in user's mobile device.

(iii) Accessibility (Time Window)

All apps available to share data in both modes offline i.e. to store the data in mobile app locally and in online mode user gets a unique username and data of user is stored on mSwasthya portal. There is no other dependency and this facility is available round the clock.

(iv) Distance required to travel to Access Points

One of the key competitiveness of mSwasthya App Store is the availability of mobile based health, fitness and wellness based services and solutions at user's mobile devices. These applications have no travel requirements as all of the apps could be installed on user's smart phones and could be accessed by using internet connectivity.

(v) Facility for online/offline download and online submission of forms

The availability of services on Smartphone enabled users to submit data directly to the synced storage servers so all data submission could be done from the devices. Each application uses a set of related forms to get the user data like, registration and other relevant health related user inputs. These data is processed and synced automatically with the central storage servers. All the personal health records of user's data can be accessed by individual apps and also on www.mswasthya.in app store using a valid username and password. These PHR data log values are also available for download.

(vi) Status tracking

The mSwasthya system is well designed to generate various activity logs of the users, this information could be further used for preparing graphical charts and reports. All activity logs are well managed for individual users. For example in apps like 'Diabetes-Monitor' which keeps track of individuals' blood glucose values. Diabetic patients can maintain a record of the glucose values and see a trend chart to monitor their health. The app provides an indication as low, moderate and high based on the values recorded. The patients can download the diabetic trend chart and send this to a medical expert for consultation.

13. Sustainability (Give details about sustainability w.r.t. technology (technology used, user privacy, security of information shared – Digital Encryption etc. #), Organization (hiring trained staff, training etc. #), financial (Scope for revenue generation etc. #))

Technology used:

Web Platform development

The integrated development environment and technologies used for development of web portal url: www.mswasthya.in, is as follows:

- Product design and development is done using Visual Studio 2008 on .Net Framework (3.5).
- Technologies used include asp.Net 3.5 with C#, LinQ, JQuery, Json, XML Web Services, Ajax, HTML/CSS, HTML5/CSS3, and Javascript.
- MSSQL Server 2008 is used for storage and retrieval of data.

Mobile application development

The integrated development environment and technologies used for development of mobile apps which are deployed on: mGov app store, www.mswasthya.in and google play store is as follows:

- Product design and development is done using Eclipse and Android Studio as IDE
- Technology used for development is based on Android SDK (2.3 and above).
- XML based web services for integration of applications with the data storage servers.
- Emulators based testing of developed apps.
- SQLite is used for storage of data on mobile devices.

Dedicated multicore hosting servers with cloud computing technologies are used with windows 2008 based operating systems on which software solutions and services like IIS7 based webserver, MS SQL Server 2008 based data servers are configured.

The hosted server has the basic technological solutions deployed for running the portal. Such solutions includes the deployment of .Net Framework (3.5) on the hosted server so that the web portal which is developed using asp.Net with C#, LINQ, JQuery, Json, XML Web Services, Ajax, HTML/CSS, HTML5/CSS3, JavaScript could be hosted.

All mobile apps with self-signed signatures are then published and hosted on www.mswasthya.in app store, mGov Store and Google play store. These web portal and mobile apps are tested on various Tablets, Mobiles including Samsung Galaxy S-II, Samsung Galaxy S-III, Google Nexus 5, LG e51 and Samsung galaxy tab2.

User privacy, security of information shared:

Thus from world-leading firms to major government departments improved cyber security could result in reduce risk – and ultimately improve business performance. Having the concern that the users would be sharing and storing there personal health and clinical details on mSwasthya , it was imperative to have a strong and robust system with all security measures plugged in. mSwasthya is well designed because more and more user information is being integrated with the expansion of services and applications, and also to verify data integrity and access control. It includes theses security concerns:

- Thus major encryption algorithms are written with MD5 based encryption.
- The threat for scripting of auto generated attacks for login is always there, so CAPTCHA is provisioned to ensure that the user is human.
- A two-step SMS based registration process is adopted to authenticate all users.
- All login activities are maintained with proper logs.

'mSwasthya' ID is the essential part of application development, the user can login and save his/her health data from all the apps that he/she is using, onto the mSwasthya cloud-enabled servers. This health information becomes part of his/her Personal Health Record (PHR), which can be accessed and updated by logging in at www.mSwasthya.in. All such activities are thoroughly tracked. This is done to provide authentication based

user logs in to applications which are made device-independent which enables the user to log in on their mobile devices to access their PHR. Developing an effective cyber security strategy is an integral part for mSwasthya based applications which are to be used by the end users.

Financial/ Scope of revenue generation details:

Include a culminating product or products that allow producers of the product to demonstrate the content standards and skills they've learned. It doesn't have to be huge but definitely should be an event that has a real users and real-world connection. Such solutions should be developed in time based phases with space for more future assessments, improved standards with a great cost effectiveness.

The mSwasthya as product is designed and developed in accordance with all such ideas in mind. This project has been funded by the Ministry of Communications and Information Technology, Government of India. The various applications which are been developed out of this project have been made available to the people at large free-of-cost. These applications are available at three different sources namely: the government of India mobile app store, the mSwasthya app store and the google play store.

In order to make a long lasting and sustainable, a sincere effort has been made to integrate various readily available mGovernance services provisioned by the Government of India. These include the use of SMS Gateway, involving both push and pull services, and the deployment of applications on the Mobile Seva app store. The use of SMS service has enabled to bring about a reduction in the cost involved in sending and receiving the SMS. While the sending of SMS from the mSwasthya server is free-of-cost, special rates have been negotiated with the various telecom operators in India which enables very low cost messages from the user end. This also reduces the cost of various other associated services and maintenance of such systems. The major hold for mSwasthya is the insights gained from experienced healthcare professionals from leading public healthcare delivery institutions.

The mSwasthya apps are developed to upgrade the health awareness among users, as well as promote the preventive health care among them. So, more and more cost effective solutions are needed to be provided. Thus the no cost involved for download and use such applications will be an advantage for the product. The mSwasthya project

is independent of any medical equipment requirement. So no dependency or additional cost imposed through third party equipment's. Availability of health care services on mobile phones will encourage health awareness and reduce the frequent visits to the doctors for small health issues. This will save the cost of travelling individuals and health professionals could take care of patients which need time bound care. The personal health record data accumulated from various mSwasthya apps can further be used for medical analysis, surveys. In future the data will be available to third party apps through APIs, so that more apps can use data to provide various services to end users.

The business model for the mSwasthya apps is under consideration for in-app purchase within the apps by classifying the premium services for the end users and associating a nominal cost for it. Also a scenario to include mobile based ads is in pipeline and thus various other relevant costs would be covered with the inclusion of such business services.

14. Result Achieved/ Value Delivered to the beneficiary of the project-(share the results, matrices, key learning's, feedback and stakeholders statements that show a positive difference are being made etc):

The end user feedback always helped to resolve post deployment issues. Apps like child immunization and vaccination alert system came into existence with solution to user in the form of alerts which resolves the hassle to remember dates and thus helps the user to remind all vaccination due of their registered child with mSwasthya. Once the architectural structure of all the apps is done and apps are deployed for field trials after pre-deployment. Post deployment changes are to be considered to add features which come with comparisons and suggestions as per end user needs. One approach to streamlining this process is to set up a continuous integration system which allows you to run your testing, development of patches every time your software changes and deploy the software to a new environment when the tests pass. So by this way, various improved versions of apps like Medicine Monitor, Diabetes Monitor, BP Monitor and all other apps came into existence.

(i) To organization

The solutions to develop and deploy end user based mobile applications are always dependent upon the type of problem and structuring each real time problem according to the devices for which they need to be developed. Such solutions are also limited depending upon the environment. Thus the mSwasthya team has worked on for all such feasible solutions with certain pre-deployment problems and post deployment solutions and benefits. Thus all the solutions available within the organization has become an integral part to design and develop a system which is new to the society and organization. This helped us to earn various mobile based projects from different health departments like: School of Public Health PGI, Chandigarh.

(ii) To citizen

mSwasthya targets users from all sections social or economic of the society which also covers all age groups from children, women, young and elderly peoples. mSwasthya, with a short span of time, has seen over 10000+ app downloads from different app stores where all these health, wellness and fitness apps are deployed including stores as: mGov store, mSwasthya app store and Google Play. Such downloads enables us to provide and improve applications which could gather more and more users who believe in self-care. It has hence encouraged the use of mobiles as an empowering tool to enable healthcare and brought about a behavioral change amongst the citizens of India. The usability and features are now more improved with the concern of providing benefits to its end-users, by creating apps related to health-care we can say people are now becoming more aware about their health and fitness related updates. Their sensitization towards various healthcare practices has made them to focus on 'self-care'. With mSwasthya, people are beginning to manage their own fitness routines and worked towards curtailing down various diseases.

Apps like Walking, Cycling have helped to keep people fit and motivate them to do physical activity. They are now able to track their activity, record it and store it for later viewing. With the amount of calories burnt after each activity, it has helped people to use the apps for a better and a healthier lifestyle.

Apps like mSwasthya-CIAS (Child Immunization Alert System) have helped make people aware about the benefits of immunization. Alerts via SMS, emails have brought about a change amongst people who are taking efforts to get their child vaccinated on time.

The apps 'Calorie Counter' and 'Nutritional facts' have brought about a lifestyle change as people are moving towards healthy diets. By taking small steps in improving healthcare, they are hopeful of getting gigantic gains in the long run.

Likewise the app 'Hospital-Search' has made an impact on the people making a decision about choosing a healthcare delivery institution. People are getting context aware information about their nearby hospitals and can check for nearest hospitals for quicker healthcare delivery. Thus, people are now able to make an informed decision.

The mobile app 'OPD schedules' enables easy information retrieval for the patients as it has helped them to identify the operational clinics and the health care professionals for a particular day. This has saved a lot of time and harassment for the already harried patients.

Likewise the app Indian Health Stats is an important app for describing relevant information for decision-makers and the public. The Indian Health Stats mobile app uses open government data, to give a complete set of information for the users who want to access the state-wide details for all health stats. The Indian Health Stats Mobile Application is completely based upon the key indicators (stats) for health datasets which are available on data.gov.in for: Crude Birth Rate, Crude Death Rate, Infant Mortality Rate, Neo Natal Mortality Rate, Maternal Mortality Rate, Sex Ratio, Under Five Mortality Rate, Stillbirth Rate, Total Fertility Rate, and Life Expectancy at Birth.

(iii) Other stakeholders

Presently, the health care policy makers in India don't have the actual Personal health record analysis system till date. Thus the analysis of all real data may lead to provide proper details of region-wise, state-wise and age-wise health care data from real end users. Such analysis may be used to generate more impeccable policies for the state-wise citizens of India.

15. Extent to which the Objective of the Project is fulfilled-(benefit to the target audience i.e.G2G, G2C, G2B, G2E or any other, size and category of population/stakeholder benefited etc):

mSwasthya targets users from all sections social or economic of the society which also covers all age groups from children, women, young and elderly peoples. mSwasthya, with a short span of time, has seen over 10000+ app downloads from different app stores where all these health, wellness and fitness apps are deployed including stores as: mGov store, mSwasthya app store and Google Play. Such downloads enables us to provide and improve applications which could gather more and more users who believe in self-care. It has hence encouraged the use of mobiles as an empowering tool to enable healthcare and brought about a behavioral change amongst the citizens of India. The usability and features are now more improved with the concern of providing benefits to its end-users, by creating apps related to health-care we can say people are now becoming more aware about their health and fitness related updates. Their sensitization towards various healthcare practices has made them to focus on 'self-care'. With mSwasthya, people are beginning to manage their own fitness routines and worked towards curtailing down various diseases.

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16. Comparative Analysis of earlier Vs new system with respect to the BPR, Change Management, Outcome/benefit, change in legal system, rules and Regulations

The end user feedback always helped to resolve post deployment issues. Apps like child immunization and vaccination alert system came into existence with solution to user in the form of alerts which resolves the hassle to remember dates and thus helps the user to remind all vaccination due of their registered child with mSwasthya. Once the architectural structure of all the apps is done and apps are deployed for field trials after pre-deployment. Post deployment changes are to be considered to add features which come with comparisons and suggestions as per end user needs. One approach to streamlining this process is to set up a continuous integration system which allows you to run your testing, development of patches every time your software changes and deploy the software to a new environment when the tests pass. So by this way, various improved versions of apps like Medicine Monitor, Diabetes Monitor, BP Monitor and all other apps came into existence.

Such scenarios and solutions help us to incorporate future add-ons in the various applications deployed.

17. Other distinctive features/ accomplishments of the project:

mSwasthya app store is designed with the idea of providing health related services to citizens of India which is not readily available. So that more and more users may understand, what their smart devices are really capable off. Thus improvising a Health related mobile based technological model which could be later looked upon and most used. The future roadmap aims at addressing research areas that need further developments and investments in the measurement and use of indicators of well-being, societal progress and sustainability at state level. The Roadmap has been conceived as a dynamic tool that has been periodically updated with all future versions which have been released during the project lifecycle with some of the basic areas covered as:

Integration with wireless health sensors: In the near future the team mSwasthya would give its best to improve the healthcare through mobile based medical sensors. The smartphone manufactures are now introducing various sensors to record day to day activities, like capturing the steps taken by the users, with their heart rate information through various onboard sensors. Thus use of such innovative sensors in mobile devices has become prevalent in past few years. Now, with the improvement of wearable devices, more and more future add-ons are done to improve the sensor based hardware for future devices. There are number of sensors available in the market for recording certain health details. Out of these most commonly used are for measuring blood pressure, diabetes, ECG etc. which is used to capture data using wireless technologies like Bluetooth.

Opening up of Web APIs: mSwasthya would not just be a web portal or app store. It would be much more beyond that, the basic ideology for development is same as providing more improved healthcare solutions on user devices. Our future focus is to release own application programming interface (API) which specifies how some software components should interact with each other. Such API's will thus provide a platform for developers are working in healthcare domain for using these API's according to their system to develop more and more innovative mSwasthya apps. The personal medical record data will be made available to certain authenticated third party applications to allow development of more health care apps.

Analysis of medical data and generate patterns: Presently, the health care policy makers in India don't have the actual Personal health record analysis system till date. Thus the analysis of all real data may lead to provide proper details of region-wise, state-wise and age-wise health care data from real end users. Such analysis may be used to generate more impeccable policies for the state-wise citizens of India.

Accomplishments

mSwasthya has been awarded and accolade by two prestigious award functions in 2014. The "Indian Health Stats" app published under mSwasthya received the "#OpenDataApps Challenge" Award for innovation in governance under mHealth apps category, a data.gov.in initiative held in 18th, feb 2014. mSwasthya app store has been also awarded "Certificate of Recognition" under mHealth category by prestigious "mBillionth South Asia award 2014" mobile for masses, held on 18th, July 2014.