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| **Contact:** | Manjeet Singh ChalgaICMR, New DelhiIndia | Tel: +91-9582776792Email: chalgams.hq@icmr.gov.in |
| **Contact:** | Aveek DeCMS - Social Impact Specialists, BangaloreIndia | Tel: Email: aveek@cms-india.org |

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| **Abstract:** | This document contains a draft set of rules for development of AI tool for Health using Mobile Applications & Cloud-based AI applications, their testing and benchmarking. This document also invites Medical & AI researchers to collaborate in development of Cloud-based / Mobile Application based AI tools for Health within the International Telecommunication Union (ITU)/World Health Organization (WHO) Focus Group on “Artificial Intelligence for Health” (FG-AI4H). |

**Introduction:**

The use of AI in Mobile Applications is growing rapidly [1]. Its use in resource-poor countries is relatively less as compared to developed countries [2]. The healthcare mobile apps have a significant positive impact on health and health care, however, there is a challenge for patients and clinicians to find a confirmed product among infinite choice of unproven mobile applications [3]. The cloud based AI services have enabled users to access their health information from anywhere, anytime [4]. The cloud based AI services have reduced the cost, manpower and paper work [5][6][7]. The Cloud based Applications and mobile apps have a significant positive impact on health and health care, however, there is a need to discuss on technology, security and legal issues related to these applications [8]. There is a wide scope for development of Cloud-based & Mobile Application based AI tools for healthcare within the sphere of International Telecommunication Union (ITU)/World Health Organization (WHO) Focus Group on “Artificial Intelligence for Health” (FG-AI4H).

**Objectives:**

The objectives of the topic groups are as follows:

1. to prepare the rules for development of AI tool for Health using Mobile Applications & Cloud Applications
2. to provide a forum for open communication among various stakeholders,
3. to discuss on technology, security and legal issues related to these AI tools
4. to coordinate the benchmarking process in collaboration with the Focus Group management

and working groups.

**Key features required for development of AI tool for Health using Mobile Application:**

The desired key features for development of a AI tool using mobile application are that it should attract the attention of the user, serve the desires of the user and develop the faith of the user with the tool. Some desirable features/ rules may be followed as detailed below:

1. Simple Registration [9]:

Registration may be kept as simple as possible. Login may be allowed with user’s existing Facebook/ Google ID/ similar system.

1. Minimal Introduction [9]:

The introduction should not be imposed on the user. However, complete introduction may be provided on demand of the user.

1. Training/ Instructions [9]:

The user should be informed about the importance of the data required for the working of the AI tool before collection of data. The user must be explained why permission to access the camera, geolocation or similar features of mobiles are being asked.

1. Simplified user interface [9]:

All the features which are available in the desktop website version of a AI tool should be intelligently made simpler and key functions of the tool.

1. Functionality [10]:

The mobile applications should be developed keeping in view the desired features of application, target audience and the distribution channel such as Google Play, Apple App store etc. Some key points are as follows:

* Verify accessibility in respect of compatibility with mobile platforms, user friendly language, easy to use and affordability
* Confirm that mandatory fields are being collected, format of data and display of data is correct
* Proper error handling and relevant error messages
* User-friendly console of the App, appropriate size of the buttons and user manual for users
* Collection of text information should be minimized and use of checkboxes/ radio buttons should be increased.
* The font size should be clear enough to read and to select the desired option
1. Performance [10]:

Some key points for validation of the performance of mobile applications are as follows:

* The client server communication should work properly at peak, average and minimum user levels
* Identify the bottlenecks which prevent the application to perform at the required acceptability levels.
* Identify optimum response time of the app
* Identify the optimum mobile device requirement for the app
* Identify optimum performance of resources such as GPS, Camera, Battery etc in various situations
1. Security Validation:

The security of mobile applications should be validated. Some key points are as follows:

* Enforce secure communication by applying signature-based permissions, disallow access to your app's content, ask for credentials before showing sensitive information etc. [11]
* Apply network security measures by using SSL communication, applying network security configuration and creating your own trust manager [11].
* Use the best Cryptography Tools and Techniques [11].
* Get security audit of Mobile App
* Design App for handling data overflow
* Privacy policy should not be copied
* SDK may be used in place of NDK
* Encryption Key of at least 128 bits may be used
1. Positive Discontinuation [9] :

If a user wish to discontinue the use of AI tool, he/she may be allowed with clear guidelines on how to discontinue and with a simple feedback procedure.

**Types of App:**

Based on the functionality of Apps, the Apps can be defined as following:[12]

1. Native App: The App that has been developed and distributed to run on a specific platform, can take advantage of the platform and can be distributed and updated via an app repository associated with that platform.[12]
2. Web based App: Websites which are created to look like a native app but it actually run at a web browser software running on a mobile.[12]
3. Hybrid App: These are the apps which are installed as a native app, however, their functionality is delivered from a web browser. These apps have the richest functionality as compared to above two type of Apps.[12]

Details on various aspects of the App are available online which can be studied before planning to design an App [12][13][14].

On studying various mobile applications for Health running globally, these Apps can be classified as per their functionality.

1. Health Awareness Apps: These apps are mostly native or web based apps and gives awareness about a particular disease. These disease specific content management apps.
2. Apps with associated medical devices: These apps are associated with some diagnostic tools and designed to serve for a specific disease.
3. Apps for disease surveillance: In a research organisation there is a need to know the burden of the disease and a need to attach maximum patients to health service providers. There are disease specific standard questionnaires which are asked in public to know the prevalence of a disease or any problem relation to treatment seeking behaviour of the patients.

**Designing of Apps for disease surveillance:**

We observed that Apps for surveillance are mostly contains a repeated pattern of questionnaire. Thus, we designed a hybrid system which can be replicated to design dynamic Apps for surveillance. We identified that basic data types used for storing data in a server are character, varchar, numeric, float, date, datetime and logical. Similarly, we observed that a questionnaire in App mostly consists of Questions with Text input, Radio button, Check Box, Date input, Time input and List Box. The questions may be in English and other language. One question may link to another question, such as, if gender is male then questions will be different and if gender is female questions will be different. Keeping in view these general nature of questionnaire we designed a simple database namely questionnaire\_detail which can be used to create questionnaire. The main fields of this database are as follows :

1. Tablename : this field contains the name of table which will keep the data of questionnaire
2. Fieldname : this field contains the field name where answer of question will be saved
3. Question : this field contains the actual question to be asked
4. Question\_OL : this field contains the actual question in other language
5. Type\_of\_field : It contains the data type of field i.e. character, varchar, numeric, float, date, datetime or logical
6. Size\_of\_field : It contains the data size of the above field
7. Type\_of\_question : It contains the detail about how the question is to be asked i.e. Text input, Radio button, Check Box, Date input, Time input and List Box
8. Option\_text : if question type is radio button or checkbox, this field contains the detail of option say Yes, No or Male Female etc.
9. Option\_code : if question type is radio button or checkbox, this field contains the code for the option say 1,2 or A,B etc.
10. Enable\_field : if selection of a option enables more questions, this field contains the details of the fieldnames comma separated which are need to be enabled.
11. Disable\_field : if selection of a option disables some questions, this field contains the details of the fieldnames comma separated which are need to be disabled.
12. Page\_no : This field contains the page number at which the question is need to be appeared.

A mechanism has been developed in a web based server system which automatically create tables by reading above questionnaire\_detail table. A mobile app is designed which copies questionnaire\_detail table from server to mobile application, automatically create tables by reading questionnaire\_detail table and creates dynamic questionnaire for surveillance. In this manner by designing a single App we are carrying various surveys and research works. This questionnaire\_detail table has been found to be very useful for synchronizing data from mobile App to Web based Server, generation of dynamic view of the data copied from mobile App.

**Result:**

The developed mechanism reads the tablename, fieldname, fieldsize, type of field and creates the tables in web based server and mobile app automatically. The developed mechanism reads the question text, type of question, text of options if it is a radiobutton/check box and creates the questionnaire. The data save query is generated from the table. Checks on data is also placed using this system. Data synchronization from mobile app to web based server also uses the same mechanism to transfer the data.

Example of the questionnaire developed automatically is as follows:

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| 1 | Principal Investigator  |  |
| 2 | Index Patient Name  |  |
| 3 | Household number: (If applicable)  |  |
| 4 | Household contacts vaccinated  | Yes No  |
| 5 | If you are willing to provide responses to our questions, kindly state your willingness  |  |
| 6 | Willing to provide responses  | Yes No  |
| 7 | Name of the interviewer  |  |
| 9 | Date of interview  |  |

The datails of some research projects being carried using above mechanism are follows:

1. Targeted Intervention to Expand and Strengthen TB (TIETB) Control in Tribal Populations under the Revised National Tuberculosis Control Programme, India
2. Screening and Early Detection of Cervical, Oral and Breast Cancer in Cachar, Assam
3. Screening and early detection of cervical, breast and oral cancer in the Dibrugarh, Assam: a demonstration project in TATA Tea gardens
4. Prevalence of fluorosis in the community of selected districts of India and development of an appropriate intervention model from prevention and control of fluorosis
5. Programmatic Implementation and Comparison of MIP Vaccine Immunoprophylaxis and Rifampicin Chemoprophylaxis for Contacts for Leprosy Patients under the National Leprosy Eradication Programme (NLEP) in High Endemic Settings

**Call for Topic Group Participation in AI4H applications and platforms**

The International Telecommunication Union (ITU)/World Health Organization (WHO) Focus Group on “Artificial Intelligence for Health” (FG-AI4H; https://www.itu.int/go/fgai4h) seeks engagement from members of the medical and artificial intelligence (AI) communities to collaborate in development of Cloud-based & Mobile Application based AI tools for Health.

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