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| **Abstract:** | This document contains a discussion on development of AI tool for Health using Mobile Applications & Cloud-based AI applications. This document describes type of mobile applications and the development of App based system for disease surveillance in the health sector. |

**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 [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 discuss on development of AI tool for Health using Mobile Applications & Cloud Applications
2. to discuss on development of App based system for disease surveillance in health sector

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

The desired key features for development of 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 wishes 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 Mobile Application:**

Details on various aspects of the Mobile App are available online which can be studied before planning to design a Mobile App [12][13][14]. Summarizing, the Mobile Apps can be classified as following based on the functionality of Apps:

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]

Classification of the Mobile Apps presently popular in health sector are:

1. Health Awareness Apps: These apps are developed to provide awareness about a particular disease.
2. Apps with associated medical devices: These apps are being used as diagnostic tools and designed to serve for a specific test.
3. Apps for disease surveillance: These apps are commonly being used by research organisation to know the burden of the disease. They contain objective specific standard questionnaires to know the prevalence of a disease or any problem relation to treatment seeking behaviour of the patients.
4. Apps for volunteers willing to join a health survey: These apps are commonly being used by many organisation to collect information from volunteers to achieve a specific goal.

**Development of App based system for disease surveillance in health sector**

Most of the disease surveillance programs have similar format of questionnaire and field survey activities. We developed a common format of database in a cloud based system and a mobile application. Thus the questionnaire added into cloud based system can be synchronized with the mobile application. In the mobile application a modules are developed to read the questionnaire and to prepare the dynamic interface to collect data from the user. Due to similar format of database in cloud based system and mobile application, the data synchronization between mobile app and cloud based system is also made dynamic. This system found to be very useful as it enabled to prepare different disease surveillance App by making minimal changes in the system.

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

1. Mobile App based system is developed to study the prevalence of TB in Tribal areas: In the project data is collected from TB Patients, Contact of TB Patients, Community Persons, Health workers and Medical Officers from Tribal Areas of 17 Districts of India. The App also helped to follow the intervention program for the TB patients. For intervention 35 Mobile vans equipped with Digital X-ray and sputum microscopy services were launched in 2017-2018.
2. Mobile App based system is developed to study the prevalence of Cervical, Oral and Breast Cancer in North East part of India: In the project 260+ health workers were trained for conducting survey using mobile App. They surveyed 55,600+ population and identified 5600+ suspected cases. Further investigation of suspected cases is being followed through cloud based system.
3. Cloud based system to study the prevalence of Fluorosis: In this project a cloud based system is developed and surveyed 50000+ population from 7 districts of India.
4. Mobile App based system is developed to study the Comparison of MIP Vaccine Immunoprophylaxis and Rifampicin Chemoprophylaxis for Contacts for Leprosy Patients: Using this system 17000+ families are surveyed
5. Mobile App based system is developed using mobile Alarm system and its control through cloud based system: In this study the efficacy of mobile app for analgesics and adjuvants’ adherence on cancer patients receiving palliative care is being conducted. Presently 135 patients are being monitored through this system.
6. Cloud based system to study Effect of Pandemic on TB Vaccine Trial: In this project a cloud based system is developed and information is being collected from 18 sites in India.

**Result:**

Dynamic Apps and cloud based CMS type systems can be developed by designing a system constituting a common database format which can maintain dynamic questionnaire for disease surveillance based research projects. Such system enables to create quickly a surveillance system for any disease. The data synchronization and data analysis become simple and powerful.

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