Journal of Tropical Agriculture 58 (1): 83-89, 2020

Short Communication

Design and development of a mobile application for agricultural technology transfer

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Received 02 December 2019; received in revised form 28 May 2020; accepted 04 June 2020

Abstract

A mobile application is a piece of software that can be downloaded and used in a mobile phone handset, personal digital assistant, or tablet computer. The increasing number of smart phones has opened new opportunities in this area. The present study was to design and develop a mobile application in agriculture for technology transfer. The need and user requirements for the application was collected through various extension methods. The Agile software development approach was used for the development of the software. The inverted tree structure was used for content design. The contents cover detailed information on 100 crops cultivated in Kerala. The crops were categorized into broad groups for easy navigation. The interactivity and easiness of use are specially taken care in the development phase. The developed application was named as FEM@Mobile, denoting the mobile version of the Farm Extension Manager website. The content materials were tested in three layers of scientific interactions and workshops. The final application was made available in Google Play Store. By using the application, users can quickly get information on planting activity, variety details, fertilizer recommendation, inter cultivation, pest control and harvest and storage. The application acts as a ready to use guide for the farming community.

Key words: Farm Extension Manager, FEM@Mobile, Mobile application.

Agriculture plays a vital role in the Indian economy with over 58 per cent of rural households depending on agriculture as their principal means of livelihood. The need for timely access to information for decision making in agriculture and allied sectors needs no emphasis. The potential of Information and Communication Technologies (ICTs) in enabling access to and exchange of information for farmers is evident. Among ICTs, there has been increasing use of mobile phones which is changing the agricultural communication process (MANAGE, 2017).

As on 31 July 2017 the number of telephone subscribers was 1210.71 million (1186.79 million wireless and 23.92 million fixed land line telephones) as estimated by the Telecom Regulatory Authority of India (TRAI, 2017). Mobile subscriptions are expected to reach 1.4 billion by 2021, according to the Ericsson Mobility Report of June 2016 (CNBC, 2016). The growth of mobile communication technology is creating a number of opportunities for social empowerment and grassroots innovation in developing countries.

One of the areas with potential impact is in the contribution of mobile applications to Agricultural and Rural Development (ARD), by providing access to information, markets, and services to rural inhabitants (Qiang et al., 2012). There is an

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increasing number of mobile apps providing access to agriculture and allied sector information. A mobile application is a software on a mobile phone handset or tablet computer that enables a user to access specific information; make payments and other transactions; send messages; etc. The application (app) is downloaded (for free or on payment) from a wireless network from an online store and may require a live connection to function effectively.

Government of India has launched a number of web and mobile based applications free of cost for dissemination of information on agriculture related activities, for the benefit of farmers and other stakeholders. These apps can be downloaded from the official website mkisan.gov.in or from the Google play store. There are also apps developed by agricultural institutions, private sector, and NGOs. These apps are disseminating information from agricultural research and extension to farmers and other stakeholders and facilitating exchange of information among stakeholders. These apps cover a spectrum of activities starting from field operations to agricultural marketing.

An important characteristic of the mobile application is its specificity. The application has to be specific to the agro climatic peculiarities of its area of use. Further, the design should address a number of pedagogical issues concerning the end users. Once properly developed, it can serve as an effective tool in the technology transfer process. Hence, in the present study a mobile application was designed and developed to serve as a ready to use guide with respect to crop production details for extension workers and farmers of Kerala.

The mobile application was developed for the state of Kerala. The agricultural officers working in the department of agriculture forms the major identified users for the system. Apart from them, research scientists, agricultural students, and progressive farmers were also identified as potential users. Hence, the needs of all these groups of respondents were collected through a well-structured interview schedule and assessed for the design and development of the app. The total sample size taken from all the four groups was 100.

The need was assessed about the information expected by the users regarding crops. The nature of information expected from each crop was also collected. The content structure was designed in accordance with the need identified. The elements that brought dynamicity to the application were also identified.

Agile software development refers to a group of software development methodologies based on iterative development. The agile development approach enables requirements and solutions to evolve through the combined effort of the development team and the customer (Collier, 2011). It promotes adaptive planning, evolutionary development, early delivery and continuous improvements. The ultimate value in Agile development is that it enables teams to deliver value faster, with greater quality and predictability, and greater aptitude to respond to change. Hence, it was used in this study.

The Package of Practice recommendations of the Kerala Agricultural University (KAU, 2016) for the state of Kerala was taken as basic reference book. Apart from package of practice recommendations, the research findings of ICAR institutions and basic text books were also taken into account as secondary sources of information.

The content materials of the mobile application were vetted through a three stage validation process. Firstly, the content materials were prepared and corrected by the research team. Then the materials were given to two experts and their suggestions were incorporated. At a third level technological workshops were arranged with research scientists, extension personal and progressive farmers and the materials were validated.

The nature of presentation of content materials was decided as a next step. The identified features of the mobile application were used as a base for content presentation. Then, the software of the mobile application was developed and tested for its working. The final software was uploaded in Google play store and was observed continuously for user feedback and comments.

The limitations in the existing mobile app developed by various agencies were assessed from the group of respondents (Table 1). A total of 10 mobile apps developed in the area of agriculture for the state of Kerala was brought to the knowledge of the respondents. Their feedback was collected. The major limitation identified from their response was that they needed information on more crops when most of the apps were restricted to few crops (68 per cent) only. The next limitation was the poor scientific base in presenting recommendations on plant protection problems.

Table 1. Limitations of the existing mobile apps

Sl. No.	Limitation of existing mobile apps	% of respondents
1	Most of the mobile apps concentrate on few crops	68
2	Plant protection parts are not scientifically validated	65
3	Users are not able to freely navigate in the app	52
4	Functionality for contact with experts is missing	41
5	Market level information on price and arrival is missing	40
6	Huge data size and requirement of internet connection	38
7	Photos and videos are few and are not specific	35
8	No regular updating of latest information	25
9	Calculators for various operations are missing	12
10	Crop based data storage functionality required	11

The information needed through the mobile application was collected from the respondents and pooled together (Table 2). Most of the respondents needed information on diagnosis and control of pest problems (87 per cent). This was followed by information on the use of fertilizers for various crops (82 per cent).

The respondents views on the design specification of the new mobile app are given in Table 3. The ease of use was the major requirement from the end users (71 per cent). This was followed by adaptability of the system with various operating systems (64 per cent).

Table 2. Information needed through mobile app

Sl. No.	Information needed from the mobile app	% of respondents
1	Information on diagnosis & control of pest problems	87
2	Information on fertilizer usage for various crops	82
3	Organic preparations for crop health and protection	69
4	Details on various crop specific activities	65
5	Price and arrival information of nearby markets	60
6	Contact details of agricultural experts in nearby locality	50
7	Information on correct use of agro chemicals	45
8	Information on planting materials and variety	35
9	Information on method of planting and spacing	34
10	Information on deficiency symptoms and control	26

Table 3. Required design specifications for mobile app

Sl. No.	Design specifications for mobile app	% of respondents
1	Easy to locate and reach the required content information	71
2	Should be adaptable to common operating systems and phones	64
3	Photos and videos should play easily	60
4	Available in local language for farmers	51
5	Should work offline with no internet	43
6	Functionality to communicate with expert	22
7	Size of the application should be minimum	21
8	Touch screen functionality for navigation	19
9	Appealing design and colour combination	17
10	Adaptability to provide regular updates	14

A well-structured content helps to accelerate the learning process and enhances the retention of information. Therefore, a general guideline for content structuring was first designed and later the content outline and content materials were developed (Fig.1.)

The selection of crops for the system was done through user survey. The respondents were asked to list all the crops on which they needed information. There was requirement for information on 114 crops. However, since the system was designed based on Package of Practice (POP) of Kerala Agricultural University, only those crops specified in POP was taken. Accordingly, 100 crops were identified and included. Among the different crops, rice topped with 89 per cent of the requests followed by coconut (64 per cent) and banana (51

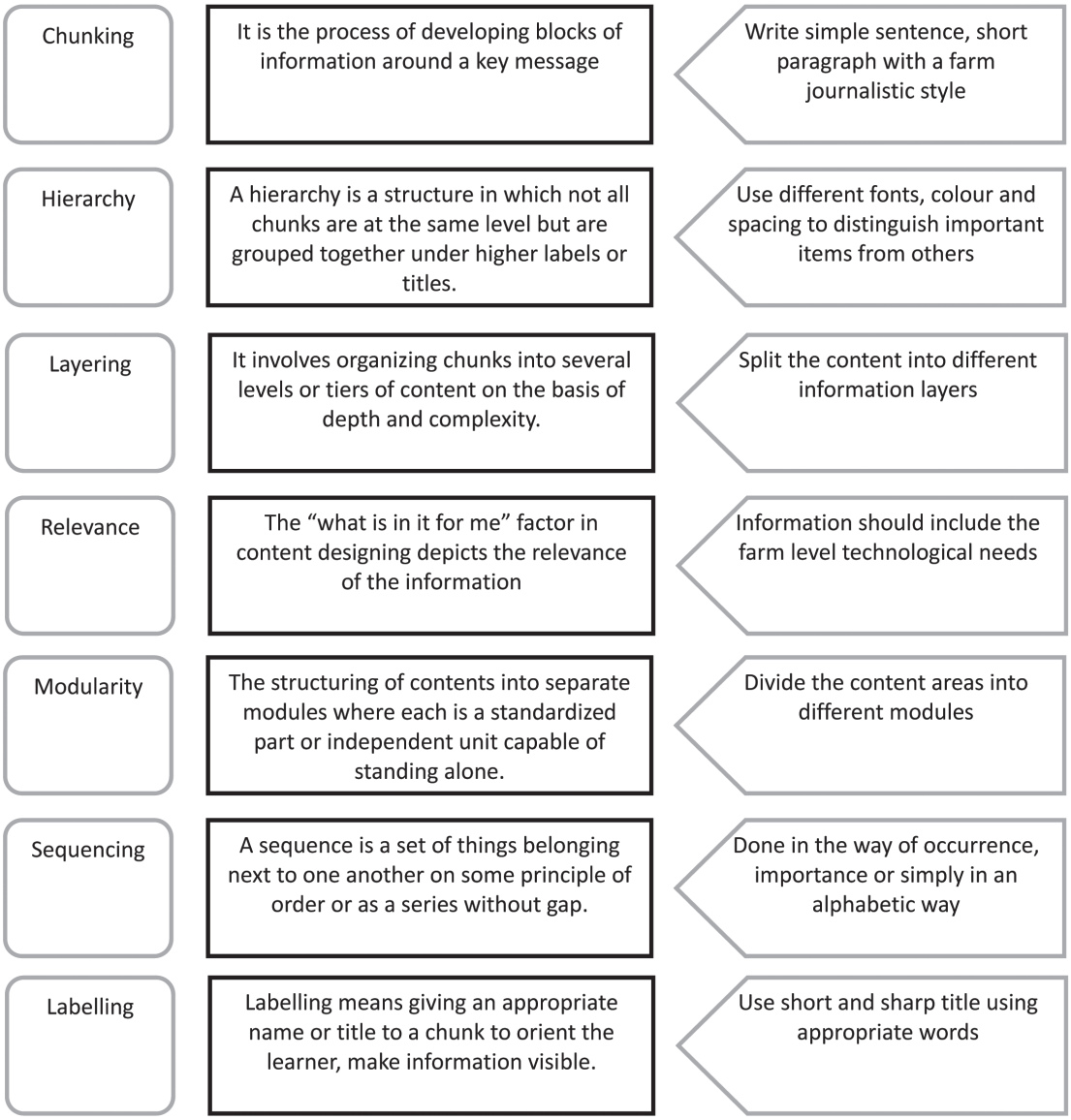

Figure 1. Guidelines for content structuring

per cent). These crops were further categorized into various broad groups for easy navigation. There were 10 such broad groups identified based on standard classification principles (field crops, spice crops etc.).

Preparation of content outlines is the process of demarking the content into various groups and sub groups within the subject matter. A well-classified content was defined to reduce the distortion loss of information. The need analysis data was used to identify the broad content areas for the mobile application.

Crop production and crop protection forms the two basic activities of agriculture. Crop production deals with all those activities related to raising the crop, while crop protection includes those methods that

Table 4. Content outline developed for the mobile app

Sl. No.	Major Heading	Sub Heading
1	Crop cultivation	Planting operations
		Variety details
		Fertilizer information
		After care
		Harvest and storage
2	Plant protection	Plant diseases
		Insect pests
		Deficiency disorder
3	Organic methods	Plant nutrition
		Plant protection
4	Agro chemicals	Soil amendments
		Chemical fertilizers
		Herbicide details
		Fungicide details
		Insecticide details
5	Expert support	Online link to connect with expert
6	Contact directory	Address book of extension officers

are taken to guard the plant from biotic and abiotic stresses. Since these two areas also assumed a top position in the need analysis part, it was decided to include them both. Similarly, information on various organic and inorganic inputs were also included. Even though marketing was an important need identified for the system, it was not included because marketing required regular update, which was beyond the purview of the system.

Based on user request, an expert support mode was also included. Here, the user could directly send photos and videos to the expert for online consultation.

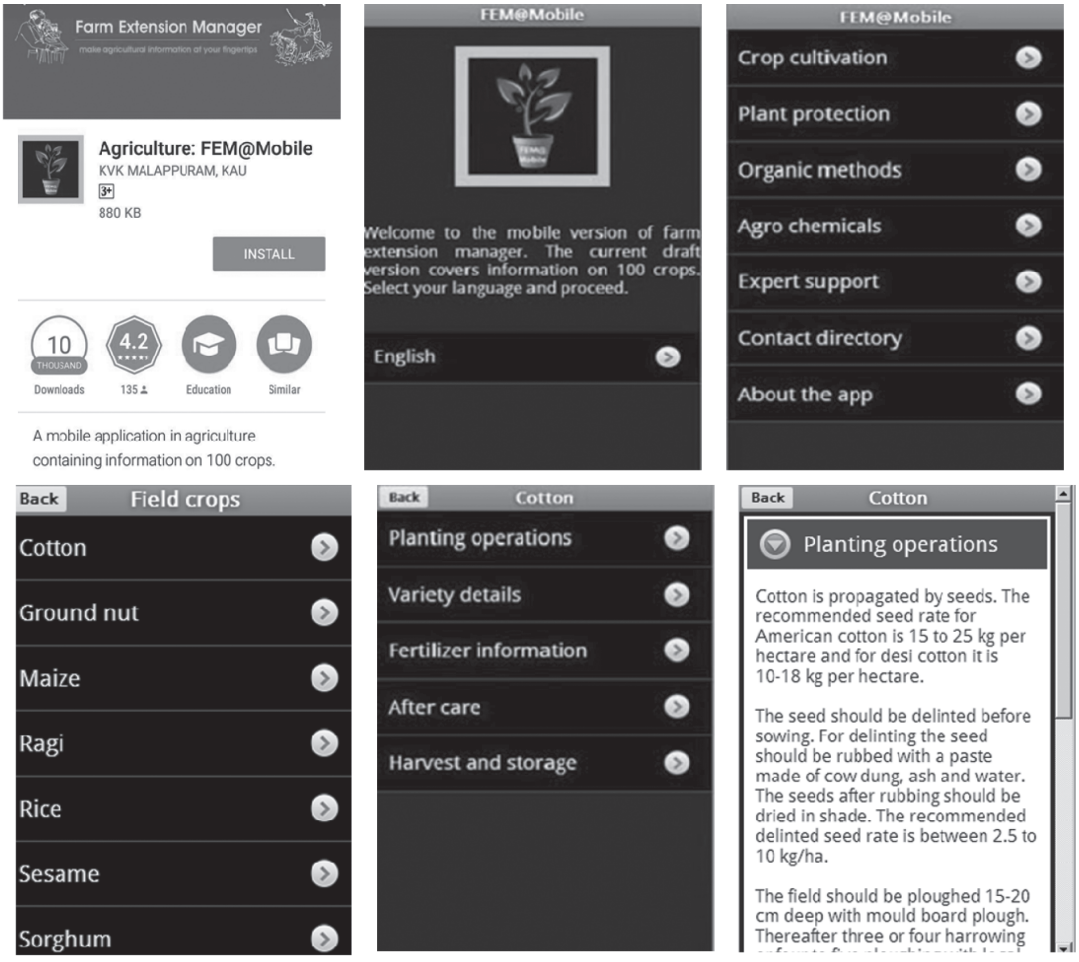

Figure 2. Screen shots on play store listing and navigation

The content materials were prepared with the Package of Practice of Kerala Agricultural University as the basic reference material. The research findings of ICAR and national institutes were also considered for preparation of the content material. The materials thus used were specified in the reference section for user information.

The content materials were first edited into the required format based on content structuring guidelines. This was followed by submitting the material to two experts for review. The materials thus prepared were given for technical validation in a workshop. The final materials thus prepared were included in the software.

Converting the theoretical design to computer design the coding and testing of the software. The development of software was done in such a way that it worked both in offline and online mode. The offline functionality facilitated the users to work without internet once installed. Internet was needed only to communicate with the expert and also to install the newer versions.

The software was developed in three basic layers. The three basic layers included the user side interface layer, the business logic layer and the database layer at the bottom. The user side interface layer represented the layer of the programme that appeared in front of the user. The user interface was designed using HTML and CSS. The business logic layer acted as the connecting link between the database layer and client side interface layer. The request from the users were processed and replied to through this layer. The business logic application layer for the programme was developed through Java script. Database layer represented the area where the basic data to be used by the system was stored. The data base layer for the system was developed as a CSV file.

The software thus developed was tested in three stages. During the first stage the working of the programme was tested. In the second stage, the language parts of the software were checked for spelling and grammatical errors. In the third stage, the programmes were used in different mobile phones and handsets to see its working. The problems noticed were rectified every now and then.

The final software was converted to android app using the adobe phone gap application. The app thus developed was uploaded in Google Play Store for easy availability to end users.

The final testing of the mobile app was done in three different stages. The respondents were first asked to undergo a knowledge test with open book and the scores were worked out. The same group were given a knowledge test with the use of mobile app after demonstrating the content layers. Here after the respondents were asked to rate the application through a questionnaire with five-point continuum for answering. The overall score of all the respondents were added and averaged to get the final result of testing (Table 5).

Table 5. Feedback after final testing of the mobile app

Sl. No.	Feedback on the mobile app	% of respondents
1	The mobile app is very simple and easy for use	88
2	The content materials covers almost all areas	81
3	There is a facility to send photos to expert	74
4	The mobile app contains authenticated information	65
5	The short paragraphs facilitate easy reading	59
6	Malayalam version of the app is needed	50
7	The fertilizer and pesticide data are user friendly	48
8	The app works even when there is no net connection	44
9	The size of the app is very small and compact	41
10	The app serves as a self-learning portal	39

The results showed that 88 per cent of the respondents found the mobile app very simple and easy to use. This was followed by the good opinion on the content materials given by 81 per cent of the respondents. Based on the results, it could be inferred that the overall design of the interactive tool had a very high acceptance among the respondents.

The mobile app was uploaded in google play store

Table 6. Feedback based on Google play store rating

Sl. No.	Google play store rating	No of respondents	% of respondents
1	Five star	112	71
2	Four star	27	17
3	Three star	9	6
4	Two star	2	1
5	One star	6	4
		157	100

and linked to google analytics. The feedback from google analytics showed that a total of 25000 people downloaded the system. The average user rating from 157 respondents was 4.4 out of 5. Most of the users found the software highly useful as seen from the user rating and comments given in the feedback area

Acknowledgement

The authors acknowledge the Department of Agriculture and Farmer Welfare, Kerala for the financial assistance provided for the project.

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