Mobile Apps: Potential ICT tools to disseminate technologies on value addition of mango, guava and aonla fruits

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ABSTRACT

ICAR-CISH has developed four mobile apps on mango products, two on guava products and two on aonla products to disseminate value addition protocols of respective fruits. In this work, mobile apps have been developed to provide advisory on preparing quality processed products of main fruits of Subtropical region. For developing apps, cloud-based tool viz. "MIT app Inventor2.0" was used. This tool can be used for app development using visual, event-based block programming method in browser itself. The apps were developed to provide advisories on preparation of quality processed fruit products such as different types of pickles, squash, *murabba*, candy, RTS drinks, etc. Apps provide audio facility as well as calculation of ingredients amount on a mouse click. These apps are very interactive and helpful to the farmers in preparing quality processed products of fruits even at cottage scale. These apps are available on 'Google Play' for free download. The information provided by app will be helpful in reducing post harvest losses of fruits, generation of employment opportunities and improve the livelihood status of the farmers.

KEYWORDS

android app, processed fruit products, post harvest, value addition, cloud computing, advisory

INTRODUCTION

Mobile Apps are software applications that can easily be downloaded and run on Smartphone and tablet Computers and have proved effective tool for technology dissemination. The 'GOOGLE PLAY STORE' is the main place to find mobile apps. There are hundreds of apps available online, covering a wide range of topics in Horticulture. Among these, many Apps are free, whereas others are priced.

Among the fruit crops, mango is considered as king of fruits and India is the highest mango producer in the word. In mango, the post harvest losses are relatively high due to perishable nature of fruits, poor post harvest management practices and low level of value addition. It is well known that several products can be prepared from raw as well as ripe mango but not many are aware of making quality products and in order to popularize value addition protocols for raw and ripe mango. Similarly, guava is also one of the main fruit crops of subtropical region which has good nutritional value. Aonla is another very beneficial fruit for good health and it has medicinal property. Though, India is leader in production yet processing of these fruits is still at negligible scale. Training to masses is an option but is cost and man power intensive. Now days, as a result of increased digital inclusion there are currently more than 300 government apps, which are facilitating essential citizen services, including information dissemination, direct benefit transfers, education and healthcare (Anonymous, 2020). Smartphones are essential

components for delivery and improving the effectiveness of e-governance initiatives as per MEITY (Ministry of Electronics and Information Technology) report.

As per the report of ICEA, in India there will be 83 crore Smartphone users by 2022. India has more internet users in rural areas than in urban. The latest report by the Internet & Mobile Association of India (IAMAI) and Nielsen showed rural India had 22.7 crore active internet users, which is 10% more than urban India's about 20.5 crore users, as of November 2019.

Easy to access information on farmers mobile is the main advantages of mobile apps. It is also true that the prevalent use of mobile devices, such as tablets or smartphones, and their low connectivity costs have made native applications an attractive and alternative solution (Montoya *et al.,* 2013).

Internet connectivity is needed to access the real time/dynamic data from the server, such as weather details, market prices, etc. Farmers need timely information to fulfil their specific needs. There are mobile apps that provide latest agricultural information on markets, farm equipments, and latest technologies help diagnose and management of pests and diseases, provide real-time data about weather, early warnings on rainfall, chances of pest diseases infestations, fertilizers etc. Moreover, farmers can also interact and get advisory from experts across the country by using the apps (Anonymous, 2017).

Keeping this in view, eight mobile apps have been developed for advising the farmers to produce high quality fruit products from raw/ripe mango, guava and aonla such as different types of pickles, Jam, Jelly, pulp, Squash, candy etc. The apps are developed in international language (English) as well as local

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language (i.e. Hindi). Some of the apps have audio facility also, which will be helpful to the rural person who is either illiterate or unable to read Hindi due to visual disability. These Apps will be helpful in reducing post harvest losses of mango and help in improving livelihood status of the farmers. In this paper details on the various mobile apps available on processed products of raw/ripe mango, guava and aonla has been discussed.

MATERIALS AND METHODS

For development of android apps, MIT app Inventor ver. 2.0 was used, which is a cloud–based app development software, developed and maintained by Massachusetts Institute of Technology. App Inventor provides a visual programming development environment. App Inventor is a web based visual blocks programming tool. It has two major elements, the Component Designer and the Blocks Editor (Kang *et al.,* 2015). Android is a mobile operating system which is built on top of the Linux kernel. The most well-known mobile operating systems (OS) for Smartphone's are Android, Symbian, iOS, BlackBerry OS and Windows Phone (Karetsos *et al.,* 2014). When using MIT app Inventor 2.0, the design work is divided in two phases: user interface design using component designer and implementation of programming logic using block editor. After completing of designing, the app is compiled and APK file is created. This APK file is the final app that can be installed on Smartphone for testing (Adiono *et al.,* 2019).

Fig. 1: Flow chart on methodology for app development and deployment

Android app development steps

The steps followed from data collection till app deployment is depicted in the flowchart of fig. 1. These are as follows:
1. In first step, app related information is collected and compiled.
2. Create Project and dashboard for linking other screens.
3. Create individual screen.
4. Design each screen by using desired component such as button, label, etc.
5. Develop code blocks that fires based on particular event (Fig. 2).
6. Compile, generate APK file and install on Smartphone or emulator for testing. If app is functioning properly then go to step (7) else go back to step (5) and rectify the problem identified during test phase.
7. Publish and deploy the final app on "Google Play St" or any suitable website.

Event Handlers and code blocks

App Inventor programs describe how Smartphone should respond to certain events: a button has been pressed, the audio start playing, the audio stops. This is carried out by event handler blocks, which used the word *when*. e.g., when Button 1. Click (Fig.2a). Event handlers are stored at the top part of each drawer (Fig.2a).
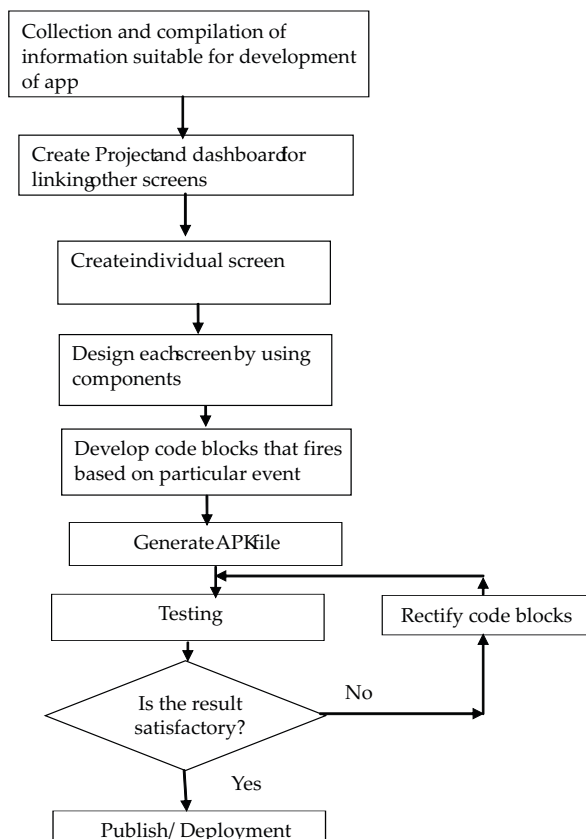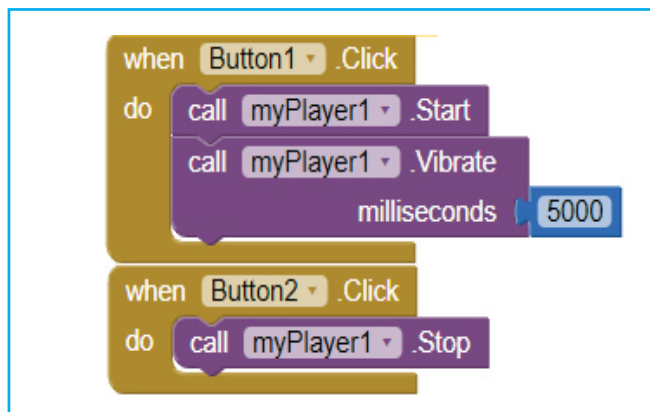

(a) Sample code showing event handler

(b)A sample code block

Fig. 2: An example of (a) event handler and (b) code blocks

RESULTS AND DISCUSSION

Apps on Mango processed products

Among the fruit crops, mango (*Mangifera Indica, L.)* is considered as king of fruits and India is the highest mango producer in the word. In mango, the post harvest losses are relatively high due to perishable nature of fruits, poor post harvest management practices and low level of value addition. It is well known that several products can be prepared from raw as well as ripe mango but not many are aware of making quality products and in order to popularize value addition protocols for raw and ripe mango.

Keeping this in view, two mobile apps entitled 'Raw Mango Products and Ripe Mango Products' have been developed with recipes to process mangoes into high quality raw mango products such as *pickles* of different types, *amchoor*, *panna* (a delicious drink for summer), etc. Ripe mango products such as Jam, Jelly, pulp, Squash, Amavat/Papad, Chutney, etc., have been discussed. These apps have been developed in Hindi as well as in English. The apps in Hindi have audio facility which will be helpful to the rural person who is either illiterate or unable to read Hindi due to (slight) visual disability. The apps in English have calculation facility for making varied amounts of products even at cottage scale industry level. These apps will help people all around the globe to make and relish Indian styled raw and ripe mango products. The provided information will help in reducing post harvest losses of raw mangoes, generation of employment opportunities and improve the livelihood status of the farmers.

App on Guava processed products

Guava (*Psidium guajava* L.) is a fruit found in tropical and sub-tropical areas around the world. It is one of the most popular fruits of Indian sub continent grouped under fruits of high ascorbic acid content. Apart, the fruit is a rich source of pectin, calcium, iron and phosphorus. Owing to wide availability, excellent taste, flavour and high nutritional value, the fruit is called as 'common man's apple'. It is often labelled as "super fruit" because it contains 4 times more vitamin C than orange, 3 times more proteins and 4 times more fiber than pineapple, two times more lycopene than tomato and potassium level higher than banana. In most of countries, guava is used as a fresh fruit and has high post harvest losses due to short shelf life. It is a well-known fact that processing is a potent measure to utilize a major portion of fruit production along with better profitability and employment generation. The app entitled 'Guava Kitchen recipes' describes the recipes for making processed guava products viz. pulp, jelly, squash, juice, powder, cheese, toffee, bar, supari, ketchup etc. The apps will be helpful to the people all around the globe to make and relish Indian styled guava products.

App on Aonla processed products

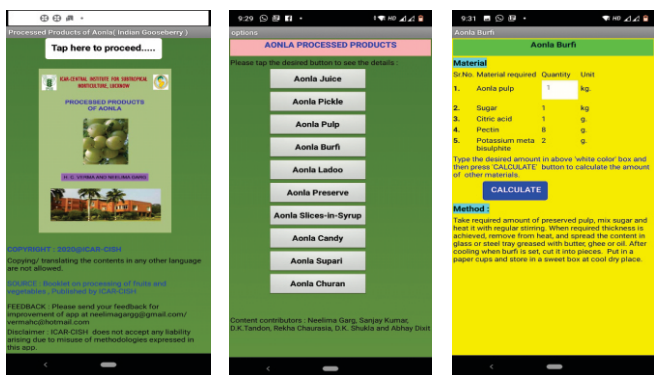Aonla (Indian gooseberry) also known as 'amla' is a very beneficial fruit of Indian origin. It is also called 'Amrit Phal' due to its unique medicinal and nutritional properties. Aonla fruit is rich in vitamin C and polyphenols. It also contains adequate amounts of carbohydrates, fiber, iron, calcium, phosphorus and other vitamins. So, regular intake of aonla helps in balancing diabetes, digestive, eye, cardiovascular and blood disorders. Due to the acidic and astringent taste, aonla fruits are not suitable for immediate use. So, they are consumed through preparation of many tasty products having useful properties of aonla. At the commercial level, juice, pickle, slices-in-syrup, candy, laddoo, burfi, supari, powder, churan and chyawanprash are prepared. Some of the recipies discussed in aonla apps (English and Hindi) are: Aonla Juice Aonla Pickle, Aonla Pulp, Aonla Burfi, Aonla Ladoo, Aonla Preserve, Aonla Slices-in-Syrup, Aonla Candy, Aonla Supari and Aonla Churan. So, we have developed eight android apps separately in Hindi and English languages for preparation of quality processed products of mango (Raw and Ripe), guava and aonla. Separate apps were developed in Hindi and English languages for same fruit products in order to keep app size within 5-6 MB because light weight apps can be easily and quickly downloaded even if Internet connection is of low data transfer rate in rural areas. No irrelevant animations or images were included in app design, because it will increase size of app and/or make app unstable. Fig 3 shows the screenshots of different screens of "Aonla processed products" app in English.

These apps are available on "Google Play" that can easily and freely be downloaded and installed of Smartphone (Fig. 4). Links for accessing these apps are also available through ICAR KRISHI PORTAL(https://krishi.icar.gov.in/mobileapp/)
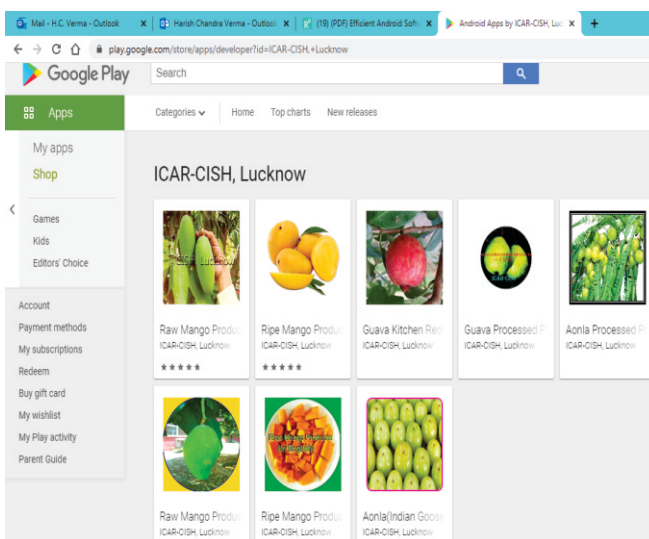
Fig. 4: Listing of apps developed by ICAR-CISH, Lucknow and deployed on "Google Play"

All of the apps are compatible with android 1.6 and up and content rating is 3+. These apps are accessible to all countries/regions of the world.

The app were downloaded globally in various countries including India, Pakistan, Bangladesh, Nepal, Sri Lanka, Saudi Arabia, United Arab Emirates, United States, Ghana,

Fig. 3: Screenshots showing different screens of "Aonla processed products" app in English

Table 1: Detail statistics on downloads of android apps developed by ICAR-CISH.

Name of app**	Langu-age	Date of Upload	Number of down loads	Descending order of downloads by different countries*
Raw mango products	Hindi	June 21, 2018	2290	India, Pakistan, Bangladesh, Saudi Arabia,
Raw mango products	English	June 30, 2017	384	India, Unknown Region, Ghana, Bangladesh, Nepal
Ripe mango products	English	June 30, 2017	168	India, Bangladesh, United States, Algeria, Myanmar
Ripe mango products	Hindi	July 27, 2018	1950	India, Pakistan, Unknown Region, UAE, Bangladesh
Guava processed products	English	October 11, 2019	81	India, United States, Ghana, Kuwait, Sri Lanka
Guava kitchen recipes	Hindi	March 31, 2019	175	India, Egypt, Grenada, Iraq, Saudi Arabia
Aonla (Indian Gooseberry) products	English	March 23, 2020	65	India, Kenya, United Kingdom, Unknown Region, Brazil
Aonla processed products	Hindi	January 8, 2020	88	India and Nepal

*As on Feb 15, 2021. **link given in reference list

Kenya, Kuwait, United Kingdom, Egypt, Grenada, Iraq, Saudi Arabia, Brazil, etc. Lowest downloads were of aonla app

(Table 1). This may be because of the fact that it was uploaded in the last. It is expected that as the time passes the download number will increase. The app reviews and rating indicated that these were found useful and liked by the users. However, the download data INDICATED Hindi based apps more downloaded than those on English based ones. In a study conducted by Jain *et al.* (2014), it was concluded that agricultural information system needs to be developed based on the mass communication technology such as mobile systems. It was also noted that localization of native language of farmers are the concerns, which is to be incorporated into the systems. In another study Patel and Patel (2016), concluded that app should be in the native language of the farmer, and then it is easy to utilize it. Our results are also supporting it where apps in local language i.e. in Hindi have more downloads than apps in English language. There is a need to popularize these through state Govt portals, Ministry of food processing portal etc., so that rural farmers can take maximum advantages of it in preparing processed products and increase their income. There is also need to develop these in regional language to popularize among rural masses in various states of India.

CONCLUSION

It has been observed that most of the users do not want to install and keep high memory consuming apps. Same is applied in case of apps that can be used in particular season of the year e.g. apps on mango are useful in summer season. In these cases, users install the apps for desired period and then remove in order to vacate the memory. The information provided by app will be helpful in reducing post harvest losses of guava, generation of employment opportunities and improve the livelihood status of the farmers.

From result, it can be concluded that the app in Hindi language has higher downloads than that of English language. So, it can be stated that one should develop apps for the purpose of advisory/ information dissemination in local language for getting attention by maximum numbers of stakeholders.

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Aonla Processed Products (in English):

Aonla Processed Products (in Hindi):

https://play.google.com/store/apps/details?id=appinventor.ai_harish 70_patel.Aonla_Processed_Products_Hindi

Guava Kitchen Recipes(in Hindi) :

https://play.google.com/store/apps/details?id=appinventor.ai_harish 70_patel.GuavaProcessedProducts_Hindi&hl=en

Guava Processed Products (in English):

https://play.google.com/store/apps/details?id=appinventor.ai_harish 70_patel.GuavaProcessedProducts_English&hl=en_IN&gl= US

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Patel H. and Patel D. 2016. Survey of android apps for agriculture sector. *International Journal of Information Sciences and Techniques* 6(1-2):61-67.

Raw Mango Products (in English) :
https://play.google.com/store/apps/details?id=appinventor. ai_harish70_patel.Raw_Mango_Product_English&hl=en

Raw Mango Products (Hindi):
https://play.google.com/store/apps/ details?id=appinventor.ai_ harish70_patel.AamKeUtpaad_New&hl=en

Ripe Mango Products (in English) :
https://play.google.com/store/apps/details?id=appinventor.ai_harish 70_patel.Ripe_Mango_Products_English&hl=en

Ripe Mango Products (Hindi) :
https://play.google.com/store/apps/details?id=appinventor.ai_harish 70_patel.Pake_Aam_Ke_Utpaad&hl=en