

**MOBILE APP FOR MAIZE: STATE OF THE ART, POTENTIAL AREAS, AND
FUTURE DIRECTIONS IN BANGLADESH**

Roshidul H¹, M A Haque², Md. Mahmudul Haque², Tapas R. Chakraborty³

ABSTRACT

The mobile phone is no longer just a communication device, but also an essential part of people's entertainment and daily life. Now android system in the electronics market is becoming more and more popular, especially in the smartphone market. The most popular smartphone application is games followed by listening to music, watching videos, communicating with social media, exploring photos, taking selfies, etc. Mobile apps also become more popular than desktop computer-based software. The mobile phone is used for different purposes activities from simple communication to video conferencing, from playing games to the utilization of apps for day to day life. Since Mobile networks reach every corner of Bangladesh, it is now a potential time to use the mobile phone for providing need-based information to the farming communities for their benefit. Since Bangladesh is an agriculture-based country and most of the farming communities subsist in the northern part of Bangladesh. It was found that Nilphamari (Northern district of Bangladesh) suitable area for providing benefits to the farming communities by developing a mobile app. The researchers chose the disease identification and their' management for the Maize crop as Maize is the 3rd most common in that area. This paper mainly discussed two sections; 1. The application interface in the Bengali language with multimodal function; text, voice with the local language, and images; 2. Feedback from the users about the app. It was found that most of the end-users were able to properly identify the diseases and manage them well.

Keywords: Mobile Apps, maize, maize app

¹ Department of Computer Science and Information Technology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh, roshidul.hasan@gmail.com

² Department of Computer Science and Information Technology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh

³ ICT and Development, Oxfam in Bangladesh

INTRODUCTION

The android operating system is becoming more and more popular in the current communication era especially in the smartphone environment. Most popular smartphone application is games followed by listening music, watching videos, communicating with social media, exploring photos, taking selfie, etc (M. Butler, 2011). Mobile apps also become popular than the desktop computer based software. And multimodal conversation becomes daily activities for mobile phone users. These advances have extended the initial application domains of conversational interfaces to complex information retrieval and question answering applications (Metze et al., 2014), e-commerce systems (Tsai, 2005), surveys applications (Stent et al., 2006), in-car systems (Hofmann et al., 2014), remote control of devices and robots in smart environments (Minker et al., 2010), e-learning and tutoring systems (Kopp et al., 2012), communication within vehicles (Misu et al.,

2015), Ambient Assisted Living systems (Bickmore et al., 2010), recommendation systems (Reschke et al., 2013), or virtual companions (Horchak et al., 2014). Griol et.al. (2016) proposed two techniques for developing conversational agents using well-known standards and operative systems, VoiceXML or Android and found Android is the best solution.

After critically analyze from the above statistics from World Bank Report (2017), it can easily be remarked the usability and availability of mobile communication to the mass people in South Asian region. The mobile phone is using now for different purpose activities from simple communication to video conferencing, from play games to utilization of apps for day to day life. Since Mobile network reach to every corner in Bangladesh, it is now potential time to use the mobile phone for providing need based information to the farming communities for their benefit. Agriculture has been the mainstay of this country since the beginning of its civilization, and communities have been established in the bank of rivers and beside fertile lands. Traditional crop varieties and cultivation practices have been sufficient to feed the population from the expansion. With the blast of population increase, the extend of land utilization expanded and after few centuries, now free lands are decreasing due to expand our cultivation on them. Scientists are now emphasizing adopting measurements which could reduce the gap between the field yield and potential yield of the crop. Bearing these factors in mind, many research attempts are in progress to manage the inputs and other factors properly, and manage the factors properly. Timely supply of crop and location specific information is a must to recommend appropriate and precise management, where mobile app can come as a savior. The Government of Bangladesh is (GOB) passed the ICT policy in 2009 updated as ICT policy 2015 and aims to build digital Bangladesh, an ICT driven nation comprising knowledge-based society by the year 2021. The GOB also passed set 7th five year plan in 2015 for FY2016-2020 to knowledge into economy (GED 2015). With the recent advancement of smart technology in everybody's smartphone, farmers are just a click away to reach for its solution. Researchers has already made some attempts on this field as well through developing mobile app for smartphone but none came as effective as to offer solution to specific problems to different field environment. Crop specific mobile apps can ensure desired information supply to the farmer to take actions against the encountered problem. Technology is not a fancy thing now a days. Almost everybody owns a smartphone running on Android OS. It was found Nilphamari (Northern district of Bangladesh) suitable area for providing benefit to the farming communities by developing an mobile app. The diseases identification and its' management of Maize crop was choosen as Maize was the 3rd most common of that area and rising crop in Bangladesh.

The mobile phone uses and users in South Asian counties increasing very fast. According to the world bank report (2017), the subscription of mobile cellular increased from 0 per 100 people in 1969 to 78 per 100 people in 2015. BuddeComm (2016) published their report for 2016 on mobile communication in title of the report "Mobile subscriber growth in Bangladesh continues" stated that the mobile subscriber growth rate in Bangladesh has been strong between 2011 and 2016. The report also found, the mobile market penetration increased from 55% in 2011 to 80% in 2014, 84% in 2015 and 87% in 2016. From the same report it was found that the mobile subscription rate is increasing in Bangladesh and International voice traffic minutes per person through mobile phones dramatically increased to 236 per 100 people (stated in Fig 1).

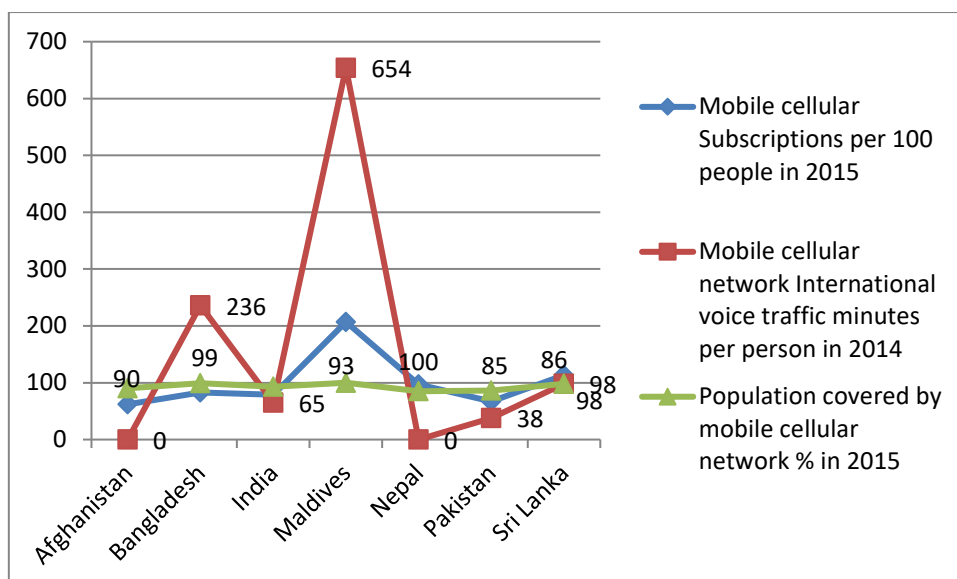


Fig 1: Development flow of mobile subscribers and it network cover over population

METHODOLOGY

The research work was conducted at the department of Computer Science and Information Technology in Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur and the selected study area was at Dakshin Kharibari, Dimla, Nilphamari district, Bangladesh from June 2015 to November 2016.

The research had conducted a survey among 46 respondents for beta testing and compatibility analysis. According to the study, it was found that out of 46 respondents, 26 were female and 20 other were male. The main research instruments were i) Primary Information of Principle Respondent ii) Experience of mobile app usage.

RESULT AND DISCUSSION

Usability of Mobile App

After having every information correctly spelled and improving the content for better understanding, authors conducted a survey among 46 respondents for beta testing and compatibility analysis. According to the study, it was found that out of 46 respondents, 26 were female and 20 other were male.

Table 1: Gender of the respondents

	Number	Percent
Male	20	43.5
Female	26	56.5
Total	46	100.0

Out of the 46 respondents, it was found that 43 of them were using smartphones, and other three didn't use smartphone, and all of them were female respondents. Among the other respondents, 4 of them were using smartphone other than android, and all of them were female. As the mobile app was compatible with android OS, they were not able to install the app on their phone. Among the other respondents having android OS phones, everybody was able to install the app, however 15 of them could not run the app on their phone. Later the researchers investigated the issue and found that their Android version was Jelly Bean or older, which was very old to run the app. Hence, it was noted the finding was a bug to conduct improvement operation. Another interesting finding was that, respondents were reluctant to use smartphone for agricultural problem solving, though 93.5% respondent had smartphone. Study shows that 34 respondents did not use smartphone for their problem-solving media, and 21 of them were female. However, in this research the researchers had provided Android smartphone to everybody to conduct the study, and it was found that 87% of the respondents were comfortable to navigate through the options of the app to study the contents and used to identify the diseases.

Table 2: Percentile of respondents able to navigate through the app

	Frequency	Percent
Yes	40	87.0
No	6	13.0
Total	46	100.0

More importantly, 95.7% of the respondents were able to find the solution of the problem using mobile app that provided to them, and the same percentile of respondents were able to understand the solution as well. These findings were ensuring the suitability of the algorithm to develop the app and the content for the app. All the respondents opined that this app was suitable for the farmers for solving their problem, and 87% of them agreed that the existing content was sufficient to solve the problem on their field regarding the diseases places on our app.

Mobile app for disease identification and management:

The visual architecture of the app was aiming at letting farmers detect the crop diseases using user friendly systematic manner. The detection system was guided through visual aid comprising identical image of original plant growth stage, plant parts and disease symptom. For classification of maize growth stages, the authors had divided the growth stage into four classes (CIMMYT, 2015) viz. 1. Seedling Growth Stage, 2. Vegetative Growth Stage, 3. Flowering and fertilization Stage, and 4. Grain filling and maturity Stage. In this research, later used representative real photo of the plant growth stages as text classification may not be understandable for the farmers. Fig. 2 shows the representative plant parts of the different growth stages in the app.

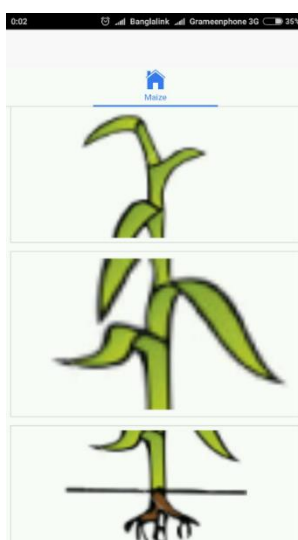


Fig 2: Representing the plant parts of the different growth stages in the app.

After growth stage selection, there comes the choice of navigating the exact area of infestation in the plant. Disease and insect infestation type varies based on the growth stage and part of the plant. For better detection, it was divided the plant diagram into three parts, viz. upper part consisting young leaf, and cob during later stages, middle part where mature leaf, stem, and tassel during flowering stage, and lower part which consists of root and part of the stem in touch of the soil. Fig. 3 illustrates the plant parts in the application which were used for selection of the disease.

The later step involves display of probable disease symptoms for this part of the plant at the selected growth stage of maize plant. Fig. 4 shows the probable disease symptoms of a maize plant in the upper part of the plant can occur during the maturity stage of the plant. This collection consists of both disease and pest infestations altogether, so that the farmers can easily select the disease properly visually. The thumbnail collection helps the farmer visually identify the disease which matches the symptom he observed on the field.

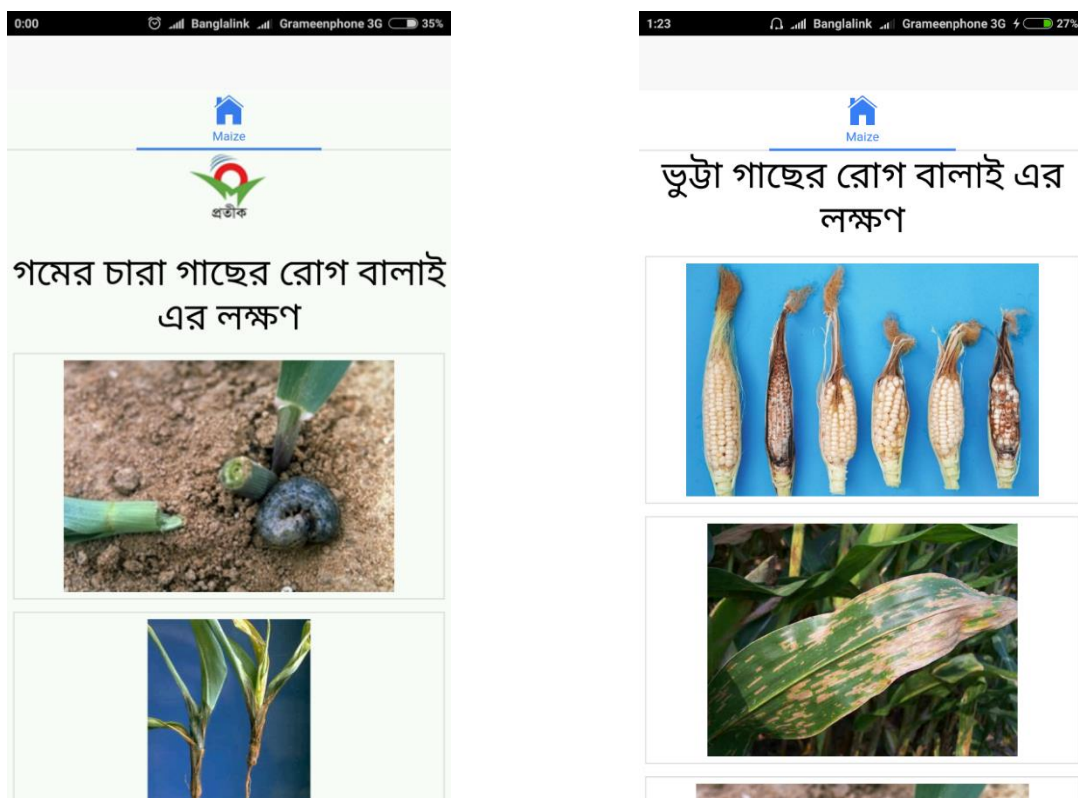


Fig. 3: The plant parts for better filtering of the disease

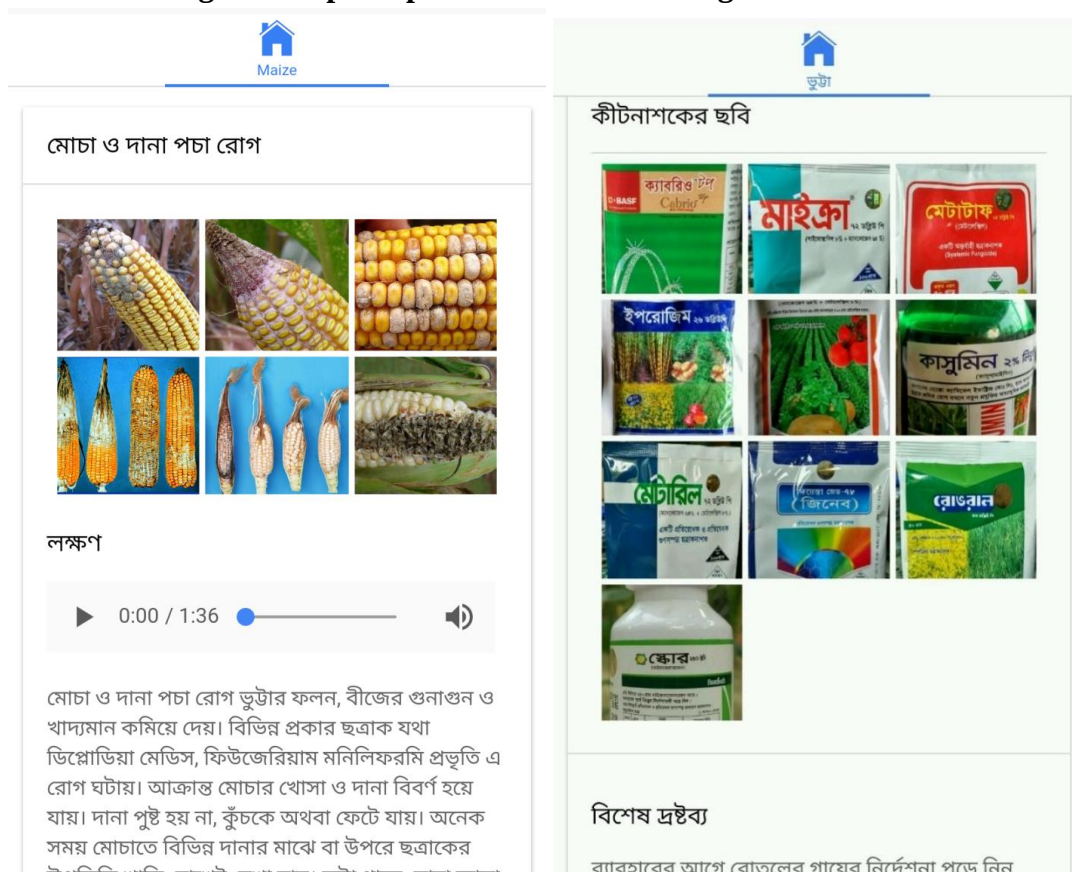


Fig. 4.: The probable disease symptoms of a maize plant in the upper part of the plant can occur during the maturity stage of the plant and management needs.

Suitability of using the app

Respondents found the app very handy to browse through the option, check different parameters and extract results. From the fig. 5, it was evident that, among the whole respondents, almost 96% of them were able to navigate through the different selection criteria to find the solution of a maize disease. Rest 4% were having issues navigating through the options, though few of them mentioned their lack of understanding the criteria as they were not maize crop grower. So it indicates the suitability of usage for the maize crop growers.

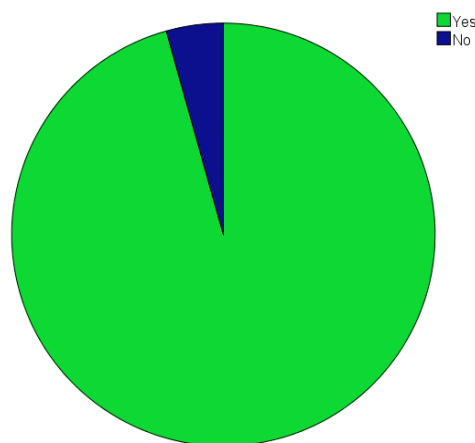


Fig. 5: Illustration of the suitability of using the app among the respondents

Understanding disease solutions through app

As it was for the case of navigation, respondents were also able to find solution of the disease they were looking for and number was similar the successful user to navigate properly (fig. 6).

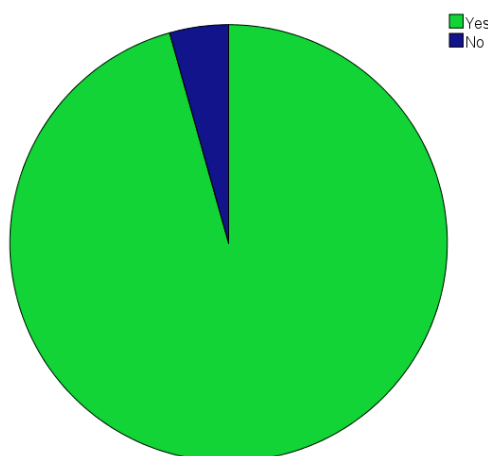


Fig. 6: Illustration of the understandability of the disease solutions among the respondents

Respondents were quite able to understand the solution mentioned in the app against each disease. Only a few respondents had hard time understanding, though majority found the solutions quite easy to understand.

Effectiveness of the app

The feedback on the effectiveness of the app for the farmers were very much satisfactory, as nobody mentioned the app as ineffective. According to fig. 7, around 52% respondents reported it as effective, while other 48% respondent reported it as very much effective.

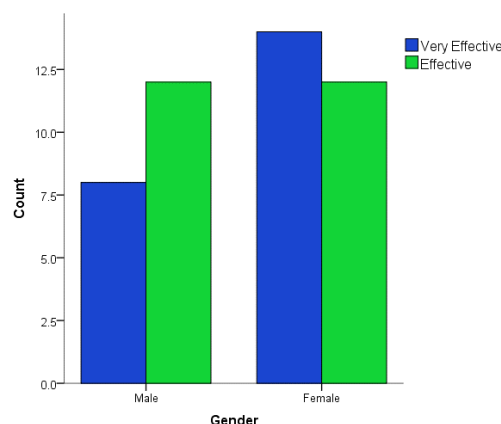


Fig. 7: Effectiveness response of the respondents regarding the app

Suitability to find solution to diseases

In regard of the suitability of the app for the farmers, it was a fantastic record as everybody reported the app was very much applicable to the farmers for getting the solution of the problems they encounter in their field. The richness of the collection of the disease and corresponding solution was not covering all the possible diseases, and respondents opined accordingly.

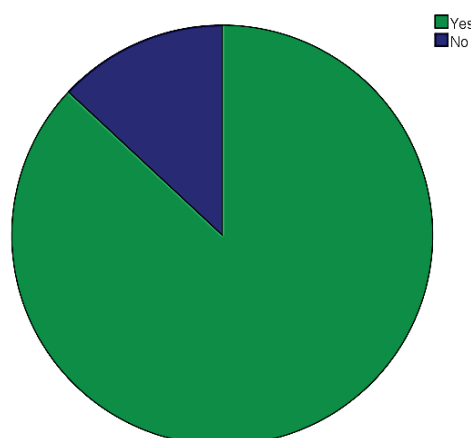


Fig. 8: Suitability of the app to find disease solutions

As it had most of the commonly encountered disease, that was why 87% of the total respondents mentioned the collection as sufficient to find solution of diseases (fig. 8). The rest 13% respondent however wanted to have all the disease information and reported alike.

CONCLUSION

Disease identification and its management for Maize was not very common for the farmers in the northern part of Bangladesh. Mobile apps with audio-image and local language (Bengali) content found very effective and 95.7% of the respondents were able to find the solution of the disease using mobile app that provided to them, and the same percentile of respondents were able to understand the solution as well. These findings were ensuring the adaptability of local language and audio-image based mobile apps for the farming communities. Finally, total of 87% of respondents were agreed that the existing content was sufficient to solve the problem on their field regarding the diseases identification and management.

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