

Development of a mobile application for amphibian species recognition

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Abstract. The smartphones mobility and its pervasiveness are beginning to transform practices in biodiversity conservation. The integrated functionalities of a smartphone have created for the public and biodiversity specialists means to identify, gather and record biodiversity data while simultaneously creating knowledge portability in the digital forms of mobile guides. Smartphones enable beginners to recreate the delight of species identification usually reserved for specialist with years of experience. Currently, the advent of Android platform has enabled stakeholders in biodiversity to harness the ubiquity of this platform and create various types of mobile application or “apps” for use in biodiversity research and conservation. However, there is an apparent lack of application devoted to the identification in herpetofauna or amphibian science. Amphibians are a large class of animals with many different species still unidentified under this category. Here we describe the development of an app called Amphibian Recognition Android Application (ARAA) to identify frog amphibian species as well as an accompanying field guide. The app has the amphibian taxonomic key which assists the users in easy and rapid species identification, thus facilitating the process of identification and recording of species occurrences in conservation work. We will also present an overview of the application work flow and how it is designed to meet the needs a conservationist. As this application is still in its beta phase, further research is required to improve the application to include tools such automatic geolocation and geotagging, participative sensing via crowdsourcing and automated identification via image capture. We believe that the introduction of this app will create an impetus to the awareness of nature via species identification.

1. Introduction

1.1. Smart phones

Mobile phone usages have been drastically growing in recent years. It could be surely said that at least three quarter of the world’s population own at least one mobile phone. Based on a study conducted in the United States, children now are more likely to own a mobile phone than a book, with 85% of them owning a phone while only 73% owns books. Without exception, Malaysia is one of the countries riding the wave of telecommunication evolution [1,2]. In recent years, the mobile phone has evolved from essentially an interpersonal communication device to a multimedia machine which is publicly known as smartphone. The use of smart phones has triggered consumer market demand as it forms a new dimension of virtual mobility to a continuing trend for geographically extended, faster and more

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personalized social interaction[2]. Hence with such an advancement and demand in mobile technology, it is believe that the biodiversity community should also follow through this advancement and not to be left behind, in advancing their approach in species identification.

1.2. Biodiversity

Biodiversity conservation is a global issue, where many government and non-government bodies have come up with many methods, techniques and even policy to ensure, the conservation of biodiversity[3,4]. But up till now majority of the identification of species in the conservation process only involves specialist researchers, policy makers and government bodies, whereas the general public involvement is very minimal and only limited to common minded enthusiast.[3]. With the development of this application, it allows knowledge sharing not only between people of the biology research community but also bridging to the general public, where it could create interest and awareness among the community [4]. As we could see that the application is very straight forward and easy even for a child. With such advantages, it will issue easier to share knowledge on biodiversity and also to encourage more individual from the general public community to be involved directly with biodiversity conservation.

1.3. Application

Identifying amphibian species is a challenging task considering the large number of existing species in the world. The interspecies similarity and the intra-species variability make the identification task particularly difficult and time consuming[5]. We present here a practical amphibian identification tool based on the visual information provided by the dichotomous key. This application is intended for mobile devices to allow a user to identify amphibian on the spot. It can also be used as an observation collector tool to enrich the knowledge database. Amphibian Recognition Android Application (ARAA) that was developed to greatly speed up the manual process of plant species identification, collection, and monitoring. Without visual recognition tools such as ARAA, a dichotomous key must be manually navigated to search the many branches and seemingly endless nodes of the taxonomic identifier[5]. Identifying a single species using this process, whereby a new and inexperienced user have to answer endless questions regarding the taxonomic identifier, may take several minutes or even hours. This is difficult even for experienced biologist, and exceedingly and may perhaps becoming an impossible task that may discourage budding amateurs[5]. It is believe that with the development of ARAA it would provide an impetus in the research community where it could reduce the time taken to identify amphibian species in the wild, hence reducing the work load of any researcher or student. It also provides rapid and mobile data retrieval from amphibian database on the query amphibian species. We predict that it would promote the understanding on amphibian species and further increases the user knowledge on the amphibian species available in Peninsular Malaysia.

2. Methodology

This android application was build based on the Rapid Application Development method that is used, specifically for system prototyping. Rapid application development is a collection of methodologies that emerged in response to the weaknesses of waterfall development and its variations [6]. Currently there is no existing android application that allows amphibian species identification of the Malaysian Peninsular. This application is design based on the web page amphibian.my that host a database of amphibian and reptile that is found in Malaysian Peninsular. Type of operating system used in this application is Gingerbread Android Operating System Version 2.3.3. This version is the most popular and widely use among all versions, making ARAA use not limited to high-end smartphones. [7].The application is built on Java platform Eclipse IDE [7,8], using the if else method, in order to retrieve result from the database and based on a simple dichotomous key with parameter scoring method in order to produce viable result. The scoring method works based on the most parameter match within the database, the highest will be on the top followed by the lowest. The parameters used for this application are, dorsal colour, ventral colour, skin type, visibility of the tympanum and the length of the snout. The layout of the application is design in such away where it allows the user to easily deploy the application. The application have three major layout page which is the “home”, the “identify” and the “result” page. There three different search method within this application where user can select from based on their preferences, which are search via amphiba.my, search via database

online, and finally search via offline database. The flow chart and data flow diagram shows how the work flows of the application and the data retrieval flow from the database (Fig. 1 and Fig. 2).

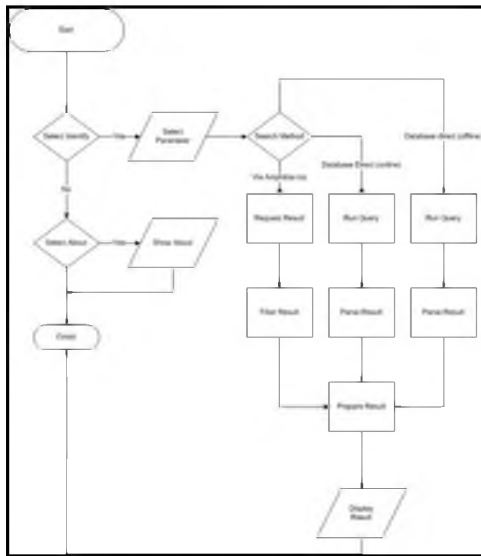


Figure 1. Flow chart showing how is the flow of the application.

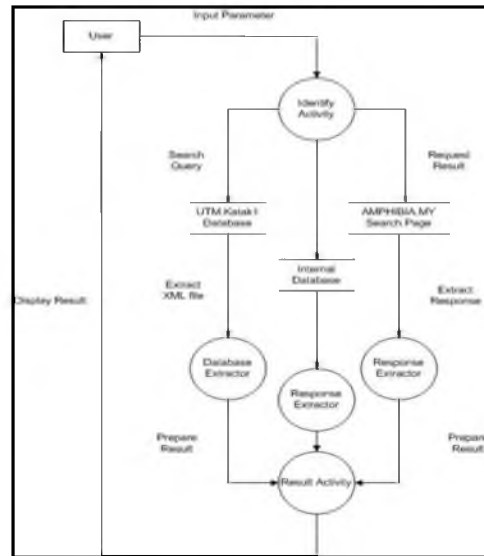


Figure 2. Data flow diagram showing data retrieval from the database.

3. Result

The result can be divided into three parts based on the search selection by the user.

3.1 Search via *amphibia.my*

User will choose the query selection from the drop down menu button in the identify page and select the search via *amphibia.my* before submitting the search. Once the search is submitted, the result will be extracted from *amphibia.my* using its search form. Here the result are presented with minimum elaboration for a much faster data retrieval and less accuracy, Results are displayed in two forms which is an image and text. The image shows the suggested species and the text describes the information on the species, that includes scientific name, snout length, tympanum, skin type, dorsal colour and as well as the ventral colour.

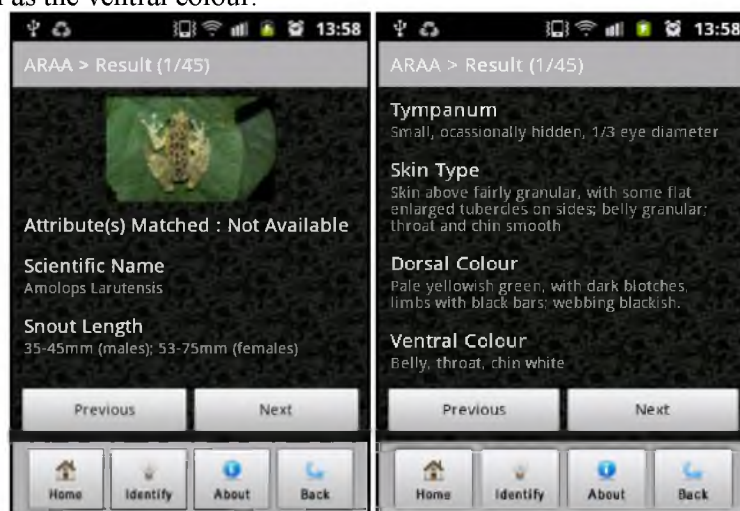


Figure 3. The result for search via *amphibia.my*.

3.2 Search via database (Online)

Users will choose the query selection from the drop down menu button in the identify page and select the search via online database option. Once the search has been submitted, the result will be extracted from ukm_katak database which is hosted in the UT server. Here the result is presented in a more elaborated manner and with more accuracy. The results are displayed as an image of the species and descriptive text containing information on the species' scientific name, snout length, tympanum, skin type, dorsal colour and as well as the ventral colour.



Figure 4. The result for search via database online.

3.3 Search via database (Offline)

User will choose the query selection from the drop down menu button in the identify page and select search via offline database function before submitting the search. Once the search is submitted, the result will be extracted from ukm_amphibia database which is embedded within the application, but in order to retrieve the species image, the user is required to have internet excess because the image is hosted in the server to reduce the application size. The result is similar to the second function albeit without the species image.

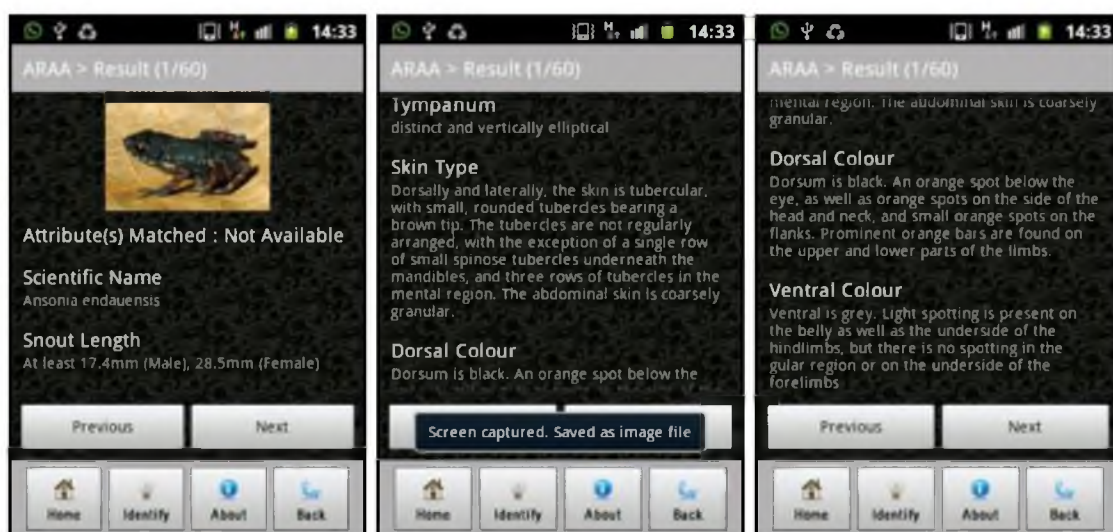


Figure 5. The result for search via database (offline).

4. Discussion

4.1 System strengths

The ARAA strength is that it could provide amphibian species identification. The user are able to retrieve data rapidly and real-time, where once they submitted the query selection in a matter of few seconds the will obtained results of possible match complete with its image and information. ARAA is also a tool to lighten researcher and students work load, where they no longer require to refer to books or manual in the wild to identify the query species, they can simply utilize the application.

4.2 System limitations

ARAA is a pilot phase application and naturally it has some limitations that require attention. The limitations that could be found in this application are that the Dichotomous key selection is not yet 100% accurate. In addition this application does not have a geo-tagging function to narrow down the search. Furthermore ARAA could not record any new amphibian species discovery, where user comes across any new species that is not present in the database they cannot submit details of their finding a new record addition into the database.

5. Conclusion

In conclusion, the ARAA could assist and lighten a burden of a researcher when they are doing their work in the field. It also could make amphibian an interesting subject for technologically savvy student, with an interactive tool for them to use as reference, but further enhancement and development is needed to make this app better. For further development, we plan to feature future functionality where users will be able to upload their findings in the field onto the database, improvements on the dichotomous key to increase the search accuracy and a geo-tagging function to narrow the search radius.

References

- [1] Osman M A, Talib A Z, Sanusi Z A, Shiang-Yen T and Alwi A S. 2012 *International Journal of New Computer Architectures and their Applications (IJNCAA)* **2** 274-85
- [2] Ting D H, Lim S F, Patanmacia T S, Low C G and Ker G C 2011 Dependency on smartphone and the impact on purchase behaviour. *Young Consumers: Insight and Ideas for Responsible Marketers* **12** 193-203
- [3] Buijs A E, Fischer A, Rink D, Young J C 2008 *The International Journal of Biodiversity Science and Management* **4** 65-80
- [4] Lindemann-Matthies P and Bose E 2008 *Human Ecology* **36** 731-42
- [5] Kumar N, Belhumeur P, Biswas A, Jacobs D, Kress WJ, Lopez I, 2012 *Leafsnap: A Computer Vision System for Automatic Plant Species Identification. In: Fitzgibbon A, Lazebnik S, Perona P, Sato Y, Schmid C, editors. Computer Vision – ECCV 2012. Lecture Notes in Computer Science: Springer Berlin Heidelberg* 502-16
- [6] Dennis A, Wixom B H and Roth R M 2008 *Systems analysis and design: Wiley*
- [7] Felker D 2011 *Android tablet application development for dummies: For Dummies;.*
- [8] Geer D 2005 *Computer* **38** 16-8