BugBytes Mobile Application

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PREAMBLE

The following report serves as a formal introduction to the BugBytes application created by students in the CMSC434: Introduction to Human-Computer Interaction course. The report addresses the existing problem, existing software, presentation of design, development process, usability testing, and future work.

Abstract

The BugBytes mobile application can be used to quickly identify a spider or snake for educational and/or emergency purposes (i.e. bites). An intuitive, visual question based system (styled after the “Twenty Questions” concept) is presented to quickly identify the animal based on its characteristics (type of creature, color, pattern, size, etc.). After questions are answered, the application displays an ordered queue of creature images based on how closely it matches the questions, as well as using the user’s location relative to the creature’s known habitat. Each creature is associated with an information page describing the seriousness of the bite, any medical treatment that could be applied immediately in the field, and whether or not to contact emergency medical services. Currently the application has gone through development and testing phases. Changes have been made to fix subtle bugs and make the application provide a more usable interface for its users.

Keywords

A. Activity - Java class used as launcher for Android development
B. Android Device - mobile device (phone and/or tablet) running an Android operating system
C. Bite Severity - the severity spider or snake wound
D. Creature Database - database used to house creature information for application
E. Java - Object oriented programming language used to develop the BugBytes application

1. INTRODUCTION

1.1 Problem

Particularly in outdoor situations, a bite by an unknown spider, snake, or other animal can be a scary thing. If a person does not know what bit him/her, how can he/she be sure if it was poisonous or requires emergency medical attention? Particularly in outdoor situations, the ability to contact poison control or other emergency medical services may be limited. Even then, attempting to describe the creature to a medical professional over the phone can be a slow and ineffective process. An application for handheld devices to quickly identify an insect or other creature, as well as the risk associated with a bite, is useful for such instances.

1.2 Existing software

Duplicating existing work is fruitless. To that end, the team looked into existing software packages or websites that attempt address our problem statement and discuss why these websites fall short.

VenomByte: This website houses a database of snakes, spiders, lizards, and scorpions and allows browsing by common name, scientific name, and state. After selecting the desired animal, the user is presented with detailed information and pictures. The drawback of this approach is that there are limited ways of searching. If a user does not know what animal they were bitten by, they will find it difficult to locate. BugBytes approach focuses on the ability to search, browse, and limit results so that a layman can find information about an animal with minimal knowledge about the bite or limited memory of what it looked like. A further drawback is that this site does not offer much medically centric information, such as symptoms or immediate treatment (Venom, 2003).

InsectIdentification: This website centered on a “bug finder”, which lets the user search for a bug by color, number of legs, and location. The search function works well, and most bugs have a
BugBytes: This website offers an extensive database of bugs ranging from butterflies to spiders. Information is comprehensive and this site offers the unique ability to register and post pictures of bugs asking for identification. BugGuide handles the social information gathering aspect well. Users can register and contribute information to a growing database. The limitation to this website is that information must be viewed while connected to the Internet (Iowa State, 2003). Ideally, we would have access to a user constructed database such as BugGuide that can easily be downloaded on to our BugBytes mobile application.

1.3 Summary

Many websites exist with information about bugs. The limitation of these websites is that they are only accessible online and no effective offline counterpart exists. While we have developed an application for displaying and searching through bug information based on a sample database we constructed, the best future course of action would be to work with a well-established website such as BugGuide to allow their database to be downloaded to our BugBytes mobile application, eliminating the need to design a system for data collection as a focus of this project. The purpose of this project is to design an Android application to support the offline and mobile needs of users in need of bug information.

2. PRESENTATION OF DESIGN

The BugBytes application is designed to allow users to identify an insect or other animal after being bitten. The layout includes an informative main page, a guided identification system, and a browsable database. The main screen provides a list of the most poisonous bugs in the user’s state. An intuitive, visual question based system (styled after the “Twenty Questions” concept) is presented to quickly identify the animal. Example questions include what colors it is, what patterns are on it (stripes, dots, hourglass marking...), its size, and other simple questions specific to the type of animal. As these questions are answered, the app displays an ordered list of creature images based on how closely it matches the questions. Each creature is associated with a creature detail page.

During the design process several prototypes were made. The following section describes important features.

2.1 Key Considerations

Contextual information such as symbols and colors can provide the user with a more intuitive interface. Because people recognize the image of a spider more easily than the word spider, creature images play a large role in our application. Originally, a black background with bright colors put the focus on information we thought was most important. However, we later learned that black backgrounds to not provide the best visibility in outdoor bright-light situations. The second prototype (Figure 6) used images of spiders and snakes on the buttons, which is indicative of the sort of functional aesthetic we wanted to provide in the finished product.

![Figure 1 – First Implementation](image)

We considered the need for a persistent emergency button that would allow users to call emergency services from any screen. However after careful consideration, we concluded that the liabilities associated with providing a button outweighed the benefits of implementation. This prompted us to place a disclaimer with the instructions to call emergency medical services as the first line of action, which later functioned as a replacement for a call emergency medical services button.

Three initial prototypes were developed during the design process. The concept of implementing a simple three button selection screen pointing to our key functionality was carefully considered. Instead it was decided to make the main screen function as a slider of creatures ranked by highest bite severity based on the state entered in the “State Selection” screen as well as a launching point to other features. We noted that the Android interface provides a set menu the user can bring up by pressing a hardware menu button, in addition to a back button. The hardware menu was not used; however the hardware back button was used to navigate back to previous screens.

The usage of BugBytes from our potential users was considered as well. Potential users range from medical professionals like doctors and emergency medical technicians to teachers and students interested in outdoors and wildlife. The specified groups’ user needs can be divided between professionals, outdoor enthusiasts, and amateurs.

Professionals in the medical, and outdoor and recreation fields would find the BugBytes application most useful as a quick reference tool. Individuals in medical professions, such as doctors, nurses, and emergency medical technicians currently have computers with access to large databases of information; however it is impossible to carry a bulky desktop or laptop around in an emergency situation. A similar situation is presented for
individuals working in outdoor and recreation fields, such as camp advisers, troop leaders, and trip leaders. Bulky laptops are not always the best thing to have along on your camping or hiking trip. A solution is to create a tool that can be used on a small transportable or mobile device (i.e. tablet, mobile phone), so in the event of a medical crisis, the medical or outdoors and recreation professional can pull it out and input the necessary descriptions for an output of possible causes.

Outdoor enthusiasts typically consist of people who frequent the outdoors for sport, such as hikers or rock climbers. Like professionals who lead trips, they are in the wilderness where Emergency Medical Service (EMS) is not immediately available. They can use the application before or after being bitten to identify a risky creature in the field, and use that information to better inform the emergency workers who will assist them. While they are not directly involved in the medical process, having this application personally can be useful to the rescue team that responds to their call. People who would benefit from this application on an informational level might include members of a scouts or other outing club. The application could be used as a learning tool to help identify what species of snakes and insects are dangerous in the wild, so they can better identify them later on.

Other users of this application may not have any specific need for the application, but may find it handy in everyday life. For instance, a strange insect could make it into the house, and someone with the application could attempt to identify so they know how to get rid of it. Similarly, a family could be in the park for a picnic when someone is bitten or stung and has a slight allergic reaction, in which case the app could be used to identify what insect they are allergic to.

We concluded that the common requirements that BugBytes users would need from our application is an interface that is fast, professional looking, and accurate. An additional constraint is added by the need to use the application in outdoor settings, where access to wireless Internet or other networks may be unavailable.

2.2 Transition Diagram:

NOTE: BugBytes uses the built-in Android button to move back between screens.

2.3 Screenshot Walk-through:

Figure 2 - This screen is the initial starting point for the application. It allows the user to select the state in which they are located. It features an auto complete box to speed up the process.
Figure 3 – This is the main screen of the application. It features a
draggable reel of creatures that are considered the most dangerous
in user’s state.

State Selection (Figure 2)

The state selection screen lets the user narrow down the creatures
he/she is searching to only those that can be found locally. The
text box has an auto-complete function, utilized to help the user
quickly find the state located in. An alternative is to select the
entire US, which is useful for recreational or educational purposes.

Main Menu (Figure 3)

Once the state is selected, the user is brought to the main menu.
From here, there are a variety of ways to find information about
the creatures in the database. At the top is a listing of all creatures
found in the state selected, ordered from left to right by their risk
to humans (bite severity). Pressing one of the pictures will
progress to an information profile page for that creature. This way
the BugBytes user can easily learn about dangerous creatures in
an area before going on a trip.

Below that are several buttons available to identify a creature the
user may have found. These are “Identify a Snake” and “Identify a
Spider”. These will progress to a screen where the user has the
option of answering various questions about the creature found,
such as color, pattern, and size. This is the best way to identify an
unknown creature found and determine if it is dangerous.

If the name of the creature is known, the user can directly navigate
to its profile page, by pressing the “Browse Creatures by Name”
button. This will alphabetically list all the creatures found in the
selected state. Simply press the name to visit the profile page.

Lastly, the help button is provided to assist users that are unsure
of how to use the application and provide a detailed explanation
of the various features inside of the application.

Identification (Figure 5)

At the identification screen, several questions are presented
related to the type of creature being identified. Simply click on
one of the headers to open up the available choices such as color,
pattern, and size.

As answers are chosen, an ordered list of pictures on the bottom is
instantly updated, ranked by closet matches. It is important to note
that a creature is never eliminated from the list based on selected
choices, to account for potential misidentifications.

If user runs into problems using this portion of the app, there is an
additional help button for the identification process.

Profile Page (Figure 4)

At the top, a larger image is provided of the creature, along with
its formal and informal names. The next section is the bite
severity. This indicates how dangerous a bite or sting from this
creature is, out of three levels. High risk creatures indicate a bite
from this creature can potentially be deadly. Medium risk
creatures on the other hand are not known to kill, but can cause
serious bodily harm. Low risk creatures generally cause pain but
no other serious injury, while creatures with a risk of none are not
known to harm humans at all.

2.4 Tutorial

A video tutorial has been produced for the BugBytes Application.
Here is a synopsis:

Figures 5 - These screens are from the guided search component
of the application. The user is able provide features about the
creatures. A list of creatures with those features is updated at the
bottom of the screen.
Below the profile page provides helpful facts about the symptoms and immediate treatment for the bite, followed by known locations.

Lastly, a general description of the creature is included. This includes facts such as its habitat, diet, whether or not it is aggressive, and how to recognize it in the wild. Note, the “Report a Sighting” and “Report a Bite” buttons are also present, however have not been given functionality. These features were saved for future implementation.

3. REPORT ON DEVELOPMENT PROCESS

When we first came up with the idea for this app, we had a very difficult time finding existing projects that accomplished the same functionality. We eventually were able to find websites that were useful for finding bugs, but our initial rough designs were entirely original concepts. We split into three teams and came up with three preliminary designs.

Upon discussing these original designs, we decided we wanted to retain several key concepts:

- A highly visceral design with extensive use of pictures
- Three methods of accessing information in the database
- A listing of the most dangerous creatures in a certain state
- A 20-questions esque game that asks about creature attributes such as color, pattern, and size
- A table like listing of the creatures for more advanced users who know what to look for
- A prompt to select the user’s state while loading, with the option to detect via GPS
- The ability to contact emergency medical services by the push of a button
- A database that can be retrieved without internet access

For the first prototype, we begin programming with the Android SDK in Java. As we encountered much trouble with getting the app to work initially, we focused on a functional design going into the usability testing. Unfortunately this meant we had to sacrifice some of the desired visceral appeal. Specifically we were not able to implement the stylized icons for various creature attribute choices. We were able to implement the three methods we planned for the database in full, although we limited the table listing to an alphabetical listing of names. The loading screen for selecting state was completed, but since we were primarily running the app on an emulator at this point we decided not to implement GPS coordinate detection. Lastly, we decided not to include a button to immediately contact emergency medical services as we were worried about the liability issues.

We decided to go with an embedded SQLite database on the Android device for storing our information as this would allow offline access. As we had a limited amount of time to fill the database, we decided to select only a few creature types and add several creatures for each so as to create a more compelling experience with the questions activity. Based on entries we found for similar websites such as VenomByte, we decided to go with
Snakes and Spiders. For each we collected a clear photograph, informal and formal name, information on bite severity, symptoms and treatment, known locations, and a general description. We were able to create complete profiles for eight creatures before we began testing.

Figure 8- Design 3

3.1 Usability Testing

Participants were asked to fill out a pre-test questionnaire to establish their background. Questions asked ranged from age and gender to general knowledge of bugs and snakes. Participants were then asked to identify animals by using three methods; location and risk level, picture, animal name. Participants were timed during these tasks. After the test had been administered, the participants were instructed to complete a post-test survey and answer questions about their satisfaction and reaction to the application.

There were a total of eight participants involved in usability testing between the ages of 20 and 22, majority of which self identified as having an average amount of knowledge about bugs and snakes. Six out of eight participants had professional outdoor experience. Five out of eight participants attested to not having smart phones and two out of eight participants attested not having 20/20 vision with or without glasses (however there was very little difference between these participants and the others).

Study participants identified problems with using the accordion layout, consistency when selecting state vs. the entire country, especially in the loading screen, name listing and profile screens. Scroll bars were given more contrast and flash upon loading a certain screen, to assist with informing the user of a scrolling panel.

Due to constraints of time and with the SDK we were using, we were not able to address the problem with indicating to the user recognizing the accordion layout and the white and black color scheme of highest importance with little to medium effort to repair. Review the Identified Problems chart to see the entire list in regards to the importance of the application and effort to repair.

### 3.2 Identified Problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Importance</th>
<th>Effort to Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>There was consistent trouble with the participants not recognizing and using the accordion layout properly</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>There is a lack of consistency when selecting by state vs. the entire country, especially in the loading screen</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>It is not immediately obvious that scrolling panels are scrollable</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Participants had difficulty understanding that returned results are ordered</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>The search by name feature is not aesthetically pleasing to users and does not actually have a “search” function</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>The white on black color scheme is not suitable for outdoor use - a primary environment our application is intended to be used in</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

3.3 Final Design

Taking our findings from the usability test into consideration, we decided our best approach to the final design was to keep the prototype and iterate over it. Our first priority was fixing the problems we listed as the most important. We changed the color scheme to be dark on light for better outdoor use; a tan background with dark red highlights. The accordion layout in the questions activity was updated to be more noticeable and intuitive to the user by increasing color contrast and size, as well as added a “+” or “-” to indicate if a particular panel was open or not. We fixed the consistency with selecting a state vs. the entire country on the loading screen, name listing and profile screens. Scroll bars were given more contrast and flash upon loading a certain screen, to assist with informing the user of a scrolling panel.
that the list of creatures on the questions panel was ordered. Similarly, we left the database listing by name portion as is, since it was still fully functional.

We were able to update few things we had in mind with our initial designs for the final version. Most importantly, we added a primitive help feature on the more complicated screens to assist new users. We removed the search button on the questions activity, and instead had the best matching creatures automatically update as choices were selected and unselected. Instead of having the tacky and misleading green star rating bar on the profile page, we created a custom rating bar with X’s highlighted in red to emphasize that a high rating indicates danger. Lastly, text fields that indicated risk were highlighted to stand out more from the background.

Conclusion

3.4 Final Implementation

In the final stage, the BugBytes team has implemented a mobile application that will work on any device running Android 2.3.4 or higher. The BugBytes application makes a database of snakes and spiders accessible to users in several ways. The database is packaged with the application to promote accessibility in areas where internet reception may be scarce.

When the application is started, users are presented with a location selection dialog, which limits the information displayed to a user’s region. The application allows users to choose a state or use the entire US as their region. Once a region has been selected, the main screen of BugBytes offers at-a-glance pictures and names of creatures in the area, sorted by highest risk. This horizontal scroll pane allows users to browse through the commonly-encountered creatures in their area; selecting one will display a page with a high-resolution photo, danger ranking, and a description of the selected creature. Alternatively, the users can select to identify a snake, identify a bug, or browse through the creatures in their area by name.

Selecting the ‘Identify a Snake’ or ‘Identify a Spider’ button presents users with a screen aimed to help identify snakes or spiders based on certain characteristics, such as color, markings, and size. As options are selected, a list of matching creatures is updated on the bottom of the screen. This allows users to quickly and accurately identify unknown creatures. Users can select a creature at any time to view the aforementioned details screen. If the ‘Browse Creatures By Name’ is selected from the main screen, users can look through an alphabetical list of creatures. Selecting any creature from the list will also present its details screen.

In keeping with Android design guidelines, the device’s back button will bring a user back to the previous screen. Using the back button, users can step back all the way to the location selection screen and even exit the application, as per normal. An onscreen ‘help’ button on certain screens displays relevant information about the BugBytes user interface, which allows curious users to become more familiar with the application.

3.5 Future Work Possibilities

Continued development of BugBytes is very likely. As the utility of BugBytes is directly related to the quality and breadth of its database of creatures, future work may focus on expanding this database, possibly opening it to outside information sources. As mentioned in the introduction, this may involve collaborating with an established information base such as BugGuide.

Additionally, future work may involve implementing additional functions in the application, such as the ability to directly contact local medical facilities for assistance or care. Branching out to various platforms, such as Blackberry, iOS, WebOS, and Windows Phone may also be considered, based on the success of the current application. As usage of the application is increased, the user interface should be constantly reviewed and improved. Lastly, providing functionality to the “Report a Sighting” and “Report a Bite” buttons can be used to add crucial information to our database about frequent bites and sightings.

3.6 Recommendations to future developers

Those looking to improve upon this idea or a similar one may be interested in understanding the scope and depth of information that the users of BugBytes represent. As this idea is developed, its usefulness will be bounded by the strength of its database; thus the more relevant and complete the database is, the more likely it is that the needs of our users are met.

4. CREDITS

Planning, development, and testing were completed solely by the BugBytes application team for CMSC434: Introduction to Human Computer Interaction term project. Members include Henry Fleming, Whitney Ford, Ryan Machado, Jamie Salts, and Robert Seng. The following serves as a breakdown of contributions to specific portions of the project:

A. Proposal: Entire Team
B. User Needs: Entire Team
C. Task & Questionnaires: Ford, Seng
D. First Design (Paper Prototypes)
   I. Design One: Machado, Seng
   II. Design Two: Fleming
   III. Design Three: Ford
   IV. Final Design: Machado
E. Development:
   I. SVN and Android Environment Setup: Salts
II. Loading Activity: Ford
III. Creature Database & Internal Logic: Fleming
IV. Questions/Identification Activity: Fleming
V. Creature Profile Activity: Fleming
VI. Activity Compilation: Fleming
VII. Code Tweaks: Fleming
VIII. Database Browse Activity: Seng

F. Usability Testing/Usability Report:
   I. Testing: Fleming and Ford
   II. Final Task & Questionnaire Form: Fleming, Machado
   III. Data Collection Analysis: Salts
   IV. Usability Report: Fleming, Ford, Salts

G. Final Report:
   I. Preamble & title page: Ford
   II. Introduction: Salts
   III. Presentation of design: Machado
   IV. Report on development process: Entire Team
   V. Conclusions: Seng
   VI. Acknowledgments: Ford
   VII. References: Ford
   VIII. Revisions: Ford

H. BugBytes Video: Fleming
I. Presentation: Entire Team

5. ACKNOWLEDGEMENTS

The BugBytes team would like to send a special thank you to Dr. Ben Shneiderman (Professor), Tak Yeon Lee (Teaching Assistant), and Elizabeth Foss (Advisor), and usability participants for assisting in the teaching, planning, and testing process.

6. REFERENCES

This website offers an extensive database of bugs ranging from butterflies to spiders. Information is comprehensive and this site offers the unique ability to register and post pictures of bugs asking for identification.


This article discusses designing interfaces for mobile devices. Chittaro points out that traditional user interface knowledge is not sufficient for designing mobile devices. This article serves as a tutorial for designing visual user interfaces that support mobile applications.

Our application will involve storing databases of animal information on the device, most likely in sqlite format. The application would need to download an sqlite file that is hosted remotely and would be available wherever the user is.

A user interface guide for existing applications in our genre of development will help lay the foundation for a more consistent and professional looking interface.

The application needs sample data that is appropriate for demonstration. This book should allow us to come up with a few sample question paths that suit the needs of a test audience.

This book explores the benefits of using modern technology to allow faster and more accurate diagnosis and treatment of diseases and afflictions. Smartphones and their implications are explored along with other innovations in the context of the future of healthcare.

This website centered on a “bug finder”, which lets the user search for a bug by color, number of legs, and location.

Mednick's covers the basics and intricacies of Java programming on the Android platform. From setting up the Android SDK to designing dynamic interfaces that fit any Android device, Programming Android is a vital resource when seeking android development advice outside of the documentation.

Because android applications use SQLite as a storage system, understanding it will be helpful to the success of our project. Ideally we would have a web application where content can be generated, stored in an SQLite format, and later pushed out to the mobile device.