The following report serves as a formal introduction to the BugBytes application created by students in the CMSC434: Introduction to Human-Computer Interaction courses. It discusses the presentation of design and the development process.

**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
D. Bite Severity - the severity spider or snake wound
E. Creature Database - database used to house creature information for application
F. 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 you don’t know what bit you, how can you 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, we have looked into any 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. Our 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.

**InsectIdentification**: This website centers around 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 comprehensive profile page. For dangerous bugs, the user is advised to seek immediate emergency care. This site offers the closest functionality to what we are looking for in our app. Its primary limitation is that it requires a computer and internet access to use.

**BugGuide**: 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. 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.

References:
http://www.venombyte.com/
http://www.insectidentification.org/
http://www.bugguide.net/

2. PRESENTATION OF DESIGN

The Bug Bytes app 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 “20 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 we made several prototypes. The following section describes features that we found important.

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. Harry’s prototype 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.

We considered the need for a persistent emergency button that would allow users to call emergency services from any screen. We concluded that we wanted to avoid liabilities associated with providing medical support or advice. This prompted us to place a disclaimer with the instructions to call emergency medical services as the first line of action. We concluded that the disclaimer would function as a replacement for a call emergency medical services button.

At the start of the prototype phase we realized that the naive approach would be to have a main screen with three buttons pointing to our key functionality. Instead the main screen functions as the “most poisonous creatures in the state screen” as well as a launching point to other features. We noted that the android interface provides a set menu you can bring up by pressing a hardware menu button. In addition android phones provide back buttons as well. This allowed us to implement the application with these features in the phone in addition to buttons on the interface.

During the design process, we considered how potential users might use BugBytes. Potential users range from medical professors 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 beter identify them later on.

General users of this application don’t 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 our 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:

2.3 Screenshot Walk-through and Tutorial

Figure 1 - 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.

State Selection (Figure 1)

The state selection screen lets you narrow down the creatures you are searching through to only those that can be found locally. The text box has an autocomplete function, so you can quickly find the state you’re in. An alternative is to select the entire US, which is useful for recreational or educational purposes.

Figure 2 – 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.

Main Menu (Figure 2)

Once you have selected your state, you are 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 you have selected, ordered from left to right by their risk to humans. Pressing one of the pictures will take you to an information profile page for that creature. This way you can easily learn about dangerous creatures in an area before you go on a trip. In future versions you will be able to limit this by creature type.

Below that are several buttons you can use to identify a creature you may have found. These are “Identify a Snake” and “Identify a Spider”, though the final version will incorporate more creature types. These will take you to a screen where you will answer various questions about the creature you have found, such as color, pattern, and size. This is the best way to identify an unknown creature you have found, and determine if it is dangerous.

If you already know the name of a creature and wish to directly navigate to its profile page, you would want to press the “Browse Creatures by Name” button. This will alphabetically list all the creatures found in your state. Simply press the name to visit the profile page. We’ll see a sample profile page in just a moment.
Lastly, if you aren’t sure exactly what to do from the main menu, the help button will take you to a more detailed explanation of the various features.

Profile Page (Figure 3)

At the top, we are shown a larger image of the creature, along with its formal and informal names. The next section is the bite severity. This will let you know how dangerous a bite or sting from this creature is, out of 4 levels. High risk indicates a bite 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.

Below this you will see some helpful facts about the symptoms and immediate treatment for the bite. The next section is the 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.

Identification (Figure 4)

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

As you choose your answers, a list of pictures on the bottom will be updated with the best matches. It is important to note that a creature is never eliminated from the list based on your choices, so you don’t have to worry about making a mistake.

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

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 to database 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.
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 was 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 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 ("USA"), figuring out the queue of creatures (scrolling panel) was scrollable, understanding results returned was ordered, aesthetics of “Browse By Name” database search, and black and white color scheme was not fitting for the outdoors setting. Out of the identified problems the participants rated the trouble with 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”</td>
<td>3</td>
<td>5</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, 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 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.

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.

The white on black color scheme is not suitable for outdoor use - a primary environment our application is intended to be used in

<table>
<thead>
<tr>
<th>Importance</th>
<th>Effort To Repair</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
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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 choose 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. As usage of the application is increased, the user interface should be constantly reviewed and improved.

### 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 was 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: Whitney Ford & Robert Seng
D. First Design (Paper Prototypes)
   I. Design One: Ryan Machado, Robert Seng
   II. Design Two: Henry Fleming
   III. Design Three: Whitney Ford
   IV. Final Design: Ryan Machado
E. Development:
   I. SVN and Android Environment Setup: Jamie Salts
   II. Loading Activity: Whitney Ford
   III. Creature Database and Internal Logic: Henry F.
   IV. Questions/Identification Activity
   V. Creature Profile Activity: Henry Fleming
   VI. Activity Compilation: Henry Fleming
   VII. Code Tweaks: Henry Fleming
   VIII. Database Browse Activity: Robert Seng
F. Usability Testing/Usability Report:
   I. Testing: Henry Fleming, Whitney Ford
   II. Final Task & Questionnaire Form: H.F., R.M.
   III. Data Collection Analysis: Jamie Salts
   IV. Usability Report: H.F., W.F., J.S.
G. Final Report:
   I. Preamble & title page: Whitney Ford
   II. Introduction: Jamie Salts
   III. Presentation of design: Ryan Machado
   IV. Report on development process: Entire Team
   V. Conclusions: Robert Seng
   VI. Acknowledgments: Whitney Ford
   VII. References: Whitney Ford
H. BugBytes Video: Henry Fleming
5. ACKNOWLEDGEMENTS

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6. REFERENCES


[4] Foster, Steven. A field guide to venomous animals and poisonous plants, North America, north of Mexico. Boston: Houghton Mifflin, 1994. 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.


[7] "SQLite Documentation." SQLite Home Page. Web. 30 Sept. 2011. <http://www.sqlite.org/docs.html>. 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.
