USING PASSTONES INSTEAD OF PASSWORDS

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ABSTRACT

As computers progressively dominate our everyday lives, the issue of security becomes increasingly more important. Every electronic account opened has a user name and password attached to it. Usually the password assigned is an arbitrary, random number given by the entity that issues the account. That means the more accounts we have, e.g. e-mail, bank account, office intranets, etc., the more passwords we must remember. Each of these passwords is an alphanumeric sequence. Since it is also recommended that we change passwords every three to six months, it could rapidly become burdensome to remember, not only all the passwords but which password goes with which account. In an effort to simplify the process, many computer users tend to select one generic password and apply it to all accounts. This then becomes a very high security risk since it becomes relatively simple to access all accounts once the first one has been breached.

Using the concept that it is easier for the human brain to remember faces than it is to remember alphanumeric sequences; *Real User* developed an alternative called "Passface". This concept requires users to remember a sequence of five faces as their password rather than alphanumeric characters. Although this may be eminently suitable for the general public, it would be difficult for persons with visual disabilities to use this type of system. The goal of this research effort is to demonstrate that a similar, yet effective, concept can be implemented using sounds instead of faces.

Categories and Subject Descriptors
K.6.5 [**Security and Protection**]: Authentication

General Terms
Security

Keywords
Authentication, Usable Security, Accessibility. Computers and Society

1. INTRODUCTION

The computer field is one of the fastest growing areas. Things that were a mere idea a few years ago are now virtually obsolete. The desire for "more, better, faster, cheaper" has greatly contributed to the speed with which electronic devices come and go. As more and more of our lives become automated, the need for security becomes increasingly crucial. In addition to these rapid changes, government mandates now require equal access to all users. The issue then becomes, how can every-day, commonplace devices be made available to all users, including those with disabilities, without compromising the necessary levels of security.

Although the Passface technology provides promising improvement over requiring users to memorize alphanumeric passwords for every computer and account usage, it does not provide a solution to the population of computer users with visual challenges.

> The basic configuration of the Passface system (five passfaces, one to be selected from each of five successive grids of nine faces) has been chosen by taking into account a combination of security, usability and practicality considerations. [7]

Use of PassFaces provides a solution to the basic computer user who is good at remembering faces. Not all users fall into that category. PassTones is an alternative that allows security access to a larger population of users extending it to the visually impaired. This research aims to demonstrate such improvement by using sounds as the password rather than text or pictures.

2. RELATED WORK

2.1 Changes in Computer Technology

The Internet is the most used computing resource available today and is no longer just a tool for research and information. There is no longer a need to leave home for banking, shopping, corresponding with friends, meeting someone new, or even filing taxes. Current internet and computer usage includes personal digital assistants (PDAs), robotics, electronic Internet commerce, e-mail accounts, online banking, and social sites such as MySpace. The on-the-go nature of modern society demands a more portable machine with PC-like capabilities that can support various types of data and applications such as spreadsheets, Web pages, video. PDA's now double as a cell phone, audio player, global positioning systems (GPS), and digital cameras [10].

The future of computers is leaning towards: more personalized hardware to match user habits; less distributed systems; more generalized content, more specific cryptology; smart card identification; biological security; more peripherals and accessories; smaller architecture; biometric technology; expanded civic/social uses; and medical potential. However, with visually impaired persons, the greater concern with the

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technological advances is the lack of security in these devices when accessing the Internet away from home.

2.2 Accessibility

The American Disabilities Act was designed to set the guidelines "for accessibility to places of public accommodation and commercial facilities by individuals with disabilities" [1].

Subsequent amendments to this Act expanded public access to include not just physical access to buildings, but access to technology. The World Wide Web Consortium (W3C) is an international organization that incorporates a combination of staff and public working together to develop standards in Web design. Their mission is "To lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the Web. One of their recommendations is the Web Content Accessibility Guidelines (WCAG) which "defines how to make Web sites, Web applications, and other Web content accessible to people with disabilities" [8].

It is readily apparent, by the amount of time and efforts invested in ensuring accessibility for all, that it is an essential requirement in this technologically advanced era. Progress has been made with developing technologies for persons with hearing and speech impairments; but not as much appears to be in place for those with visual impairments. According to the American Foundation for the Blind, "even the technically compliant sites can be inaccessible to the user, because they are so difficult to use." Driving a car may never be an option for the severely, visually-impaired person, however, he or she should enjoy equal access to e-mail accounts, online banking, and social websites. The implementation of Passtones is one method in the effort to ensure equal access that provides an alternative authentication approach for website developers.

2.3 Alternative Authentication Systems

Passfaces [4] is authentication technology added to existing security systems to complement or replace the use of traditional alphanumeric passwords. Passfaces uses human faces to verify a user's identity. It is based on the perception that people may remember faces more easily than text based passwords.

Limited research occurs in evaluating alternative authentication systems. Brostoff and Sasse [3] performed a field study of PassFaces and found that participants took a longer time to log in than with the alphanumeric alternative and therefore their time to complete tasks were increased and they logged into the system less often. It is necessary to evaluate the usability of security mechanisms to ensure that users' expectations and concerns are addressed. This is why a preliminary survey was needed for the PassTones work described here.

Saxena and Watt [5] discuss research challenges in developing authentication technologies suitable for the blind or visually impaired. Their work focuses on the use of mobile phones as an authentication proxy between the user and the system that the user intends to authenticate. However, this method requires additional development costs to incorporate the technique into system due to hardware requirements. PassTones makes use of existing website development software and therefore requires less development time and financial expense.

2.4 Security Challenges with PassTones

No system has 100% Security. However, software developers can strike a balance between good security and cost effectiveness. What might have been considered *good security* ten or fifteen years ago would not be effective given today's technological advances. It is necessary to implement a system that would not only allow the access required, but also maintain sufficient security that it would not put the accessed accounts in jeopardy of being compromised.

In addition to ensuring that information accessed in a database remains secure, software developers must also guard against the actual login in process not being compromised by what is commonly known as "shoulder surfing". In a system using voice password control, there are difficulties inherent in providing sounds for the visually impaired person to hear that would not also be heard by other persons in the surrounding vicinity. A solution must be offered that provides the sound aspect to the user but eliminates that same access to all others. While headphones would be effective if using a regular computer, it would be difficult to implement in a public environment such as a financial institution's ATM machine location. This software implementation is not designed for an ATM machine; however, the technology can be applied.

In addition to headphones, the presentation of the sequence of sounds as well as the relatively rapid pace set for advancing through the sounds could effectively minimize much of the security concerns. With the sounds being random, the possibility of *naming that song in five notes* is eliminated. The sounds would not be in the same order every time; therefore, any bystander, not knowing in advance the sequence expected, would not be likely to remember that sequence. This makes a randomly generated sound sequence the most logical implementation for this type of project.

3. PRELIMINARY SURVEY RESULTS

A viable way to provide visually impaired persons equal access to the Internet would be to use Passtones instead of the traditional alphanumeric sequences. In the preliminary stages of this research effort, a survey was conducted based on the initial concept. The survey was used to determine if PassTones could be a feasible alternative to the standard, alpha-numeric password access for a visually impaired person. Fifty two students were presented with a prototype interface of the initial Web page. The screenshot of this mockup is shown in Figure 1.

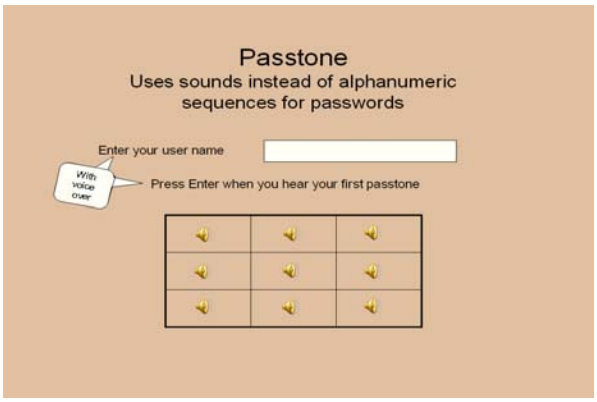

Figure 1. Interface Mockup

The initial prototype was preset with various holiday songs. Students were given a survey to complete based on their experiences with the prototype. Survey questions are presented in Table 1. The results show that the PassTones interface is viewed as effective for visually impaired persons and is easier to remember than alphanumeric passwords.

Question	Results
1. Do you think this would be effective for a visually impaired person?	**Yes** - 77% **No** - 23%
2. If you were visually impaired, do you think you would find this easier than using an alpha-numeric password?	**Yes** - 77% **No** - 23%
3. What would you do to improve this?	Shown in Table 2

Table 1. Survey Questions

Students were also asked to give feedback on improvements to the prototype. Suggested improvements are listed in Table 2. The recommendations, given in Table 2, were taken into consideration in the implementation of the PassTones. Sound bytes, such as doorbell, chimes, busy signal, applause, drum roll, and yodel were used instead of the first few notes of a song.

Recommendations	Example
1. Use different sounds for PassTones	• Shorter/longer sound bytes • Simple key tones vice actual songs • More distinction between sounds/ • More varied sounds • Using popular music • Using voice (speaking numbers) instead of sounds
2. Speed up the process	• Too much delay between sound tones
3. Potential security issues	• Limited number of combinations • Easy to determine sequence • Potentially being overheard
4. Change the way user name is input	
5. Use Braille keyboard instead of PassTones	

Table 2. Table of Suggestions

The time between each sound in the sequence was narrowed from ten seconds to five seconds. Additional testing with visually impaired persons would be ideal but a sufficient number of participates of that genre were not accessible at the time of the study.

4. IMPLEMENTATION

The basic structure of the implementation requires a Web interface as the front end with an underlying database at the back end. In addition to these main features, it is also necessary to include: a text-to-voice feature ensuring that the visually impaired person would be able to hear any text he or she could not see; voice recognition software, should the user prefer to speak the entry of user name and password; sound files for the Passtone sequences; and the database connection to the Web interface.

The implementation begins with a simple introductory page, shown in Figure 2, providing both visual and audio explanation of website navigation instructions. This is followed by the form that allows the user the option of key entry of user name and password, if desired.

Figure 2. Welcome Screen

Should the user choose not to use key entry, he or she would be allowed to use speech to enter the user name. This is possible with the use of voice recognition software used with the webpage. If voice is chosen as the method of entering the user name, the user would then be directed to select the passwords based on the series of Passtones.

The password selection screen is the third screen displayed to the users and is designed with the numbers large enough that someone with only partial visual disability would easily be able to read the numbers. The screen is shown in Figure 3.

Each number is a link which the user may click at any time throughout that sequence. In addition to being a link itself, each number in the sequence has a sound to identify it. Those nine, pseudo-randomly generated, sounds are presented for each of the five sequences. Once the user hears the correct sound, he or she would press any key to accept that sound. The combination of the five sounds selected creates the password for the account access. Initial design consideration was to use Macromedia Flash to implement a time line that would allow the sounds to come in on delay. Unfortunately that process did not readily

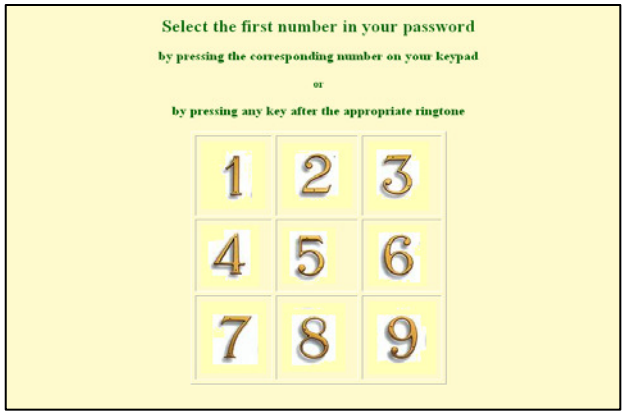

Figure 3. Password Selection

lend itself to the if-then-else structure necessary to select the choice of tones from each of the five sequences.

Microsoft Access is the database software choice, with two fields; *stored_user_name*, and *stored_password*. Sample user names and passwords entered are stored, as text data types, in the database. The entered user name and passwords are handled as strings and are compared to entries previously stored in the database. If a match is found between an entered user name/password combination and a stored user name/password combination, the user receives confirmation that he or she has successfully accessed this Experimental Design. If the user name and password entered does not match with any of the previously stored user name/password combinations, the user is informed that he or she could not be logged in and is allowed the opportunity to go back to the beginning and correctly input user name and password.

A combination of X/HTML and JavaScript was used in the creation of the project. The basic interface structure was developed using X/HTML. Java programming language was used to accomplish other features, such as text-to-voice, selection of Passtones, determining matches between entered and stored user name/password combinations, and setting the form to save to the database. The combination of JDBC and ODBC was required to establish communication between the Web form and the database. Voice recognition software was used to allow the user the option of saying the user name before selecting the password based on the sounds.

5. CONCLUSION

The need for accessibility is an issue with computer security, as in all aspects of life. How can computer technology be made more easily accessible without compromising the secure nature of transaction? The use of Passtones has the potential of being a viable solution to the accessibility issues for persons with visual disabilities. The contributions of this project includes providing a sound-based interface to websites as an alternative to visual-based input of characters in the traditional alphanumeric password or graphical password such as Passfaces. The implementation of the PassTones auditory feature eliminates the restrictions of keyboard only input and reduces the security risks of shoulder surfing. The intent of this research is to complement alternative password options so that we allow more options for users who may have visual disabilities, have trouble with spatial memory, or may just prefer a different password protection option.

The use of sounds as a replacement for visual based input of the traditional alpha-numeric password sequence provides the required accommodations for persons with visual disabilities. The interface features in this research accommodate persons with visual challenges but who have not necessarily lost full vision. Therefore, the larger numbers or, alternatively, the voice recognition software is a workable solution for allowing user name and password entry for system access. Feedback from users revealed that there is a need to also take into consideration differences in taste and preferences. Latter iterations included provisions to allow users to choose the type of sound in PassTones. For example, instead of using simple sounds, the user can select music type. Each type of music has a different selection of songs to choose from.

6. FUTURE WORK

Some additional features could make this system more robust. To lessen the possibility of someone deciphering the password by overhearing the selections, headphones could be used. This would not, however preclude them from overhearing entries made using the voice recognition software. To eliminate the likelihood of shoulder surfing to determine the sequence of numbers chosen, the sounds could be generated in random order for each sequence. This would make it difficult for others to know the password. With some additional programming and hardware modifications, PassTones could also be modified for use in a touch screen environment. It should be noted, however, that the more modifications made for convenience and/or user choices, the more complex and costly the implementation becomes; therefore a balance must inevitably be found between the need for security and the need for cost effectiveness within the accommodation genre.

7. ACKNOWLEDGEMENTS

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