
Siri Voice Interface Update

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Project:

Siri Voice Interface Update

Product:

Siri's voice interface for iOS is being evaluated

Team Name:

Team Siri

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Presentation Comments	
Report	
Total Score:	
Overall rating	<ol style="list-style-type: none">1. Exceptional2. Very Good Work3. Good4. Acceptable5. Need Improvement

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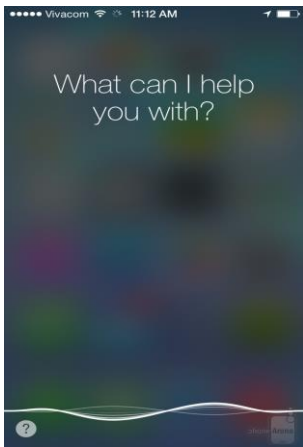

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Introduction: Product Selection

Our project is focusing on improving the user interface of the Siri application which behaves as an intelligent personal assistant by using voice input using the microphones inside of IOS smartphones and is this application is on the verge of being used inside of apple OSX operating systems. We will be planning on improving the Siri user interface by using our groups personal innovation, evaluating and explaining our ideas using user experience as well as our own personal experience as users of Siri.

Product Description

Siri is a voice interface application built into all of the recent generations of the iPhone mobile smartphone series. The voice interface is directly connected to the operating system of all iPhones in order to make the best of its functionality by working directly with the phone's system applications and other related system functions. In order to operate the voice interface, the user must hold the home button for the visual interface to come up on the iPhone screen. Then, the user can speak out any command that he or she wishes. The visual interface is shown on **Figure 1** and. **Figure 2** shows a web search command executed by Siri. For this project, the focus is to evaluate Siri, compare it with other similar products, and use the evaluation to make the voice interface component of Siri better.

	
<p>Figure 1. Siri visual interface on iPhone.</p>	<p>Figure 2. Siri executing a web search. Image gathered from</p>

Interface Evaluation

For this project, our team shall evaluate the pros and cons of Siri interface. The evaluation criteria for the interface are as follows:

1. Consistency of listening state

To initiate Siri to listen, user must hold the home button for 1-2 seconds. Siri continues to listen until Siri recognizes a pause, which indicates the voice command is finished. Users can

choose to end the command by tapping the microphone button. This feature is beneficial for all users because an extra click is saved and not much task time is subtracted.

After multiple tests, we concluded that Siri stops listening after 1-2 second of silence. However, the pause is dependent on the network connection and background noise. Setting aside the dependencies, 1-2 seconds is still a short timespan for users who are slow speakers or thinkers. Thus, there is very little consistency in how Siri can detect how to switch from a listening to a processing state.

2. Error Tolerance in terms of *Background noise*

When using Siri in a noisy environment, background noise often affects Siri's listening state. This issue is unsatisfying for user experience and inefficient for the task. Siri picks up sensitive noise which is helpful for soft speaking users. However, the sensitivity can also produce many errors. As an example shown on **Figure 3**, our team evaluated Siri error tolerance inside a car with passengers speaking at the same time as the driver/user of Siri. With the iPhone on the passenger's seat, driver's voice command is likely to blend in with the background noise from other passengers. Our evaluation proves that Siri is not always reliable to distinguish the difference between a command and background noise. The manual error handling can be tedious and reduce user's' overall time to complete the task.



Figure 3. Example of a common error where Siri picks up background noise after "...my way" instead of ending listening state.

3. Suitable for Hands Free Users

Siri's hands free mode targets users who are not able to use Siri's touch interface such as starting and ending Siri's listening state via touch because his or her hands are either occupied or the user is in a situation too dangerous to interact with the touch interfaces such as those are driving or cooking. When using hands free mode, users often cannot end their command by tapping the button. To evaluate this feature, our team tested in a noisy environment while driving. We tested Siri without using any touch interfaces. This feature helps traffic safety tremendously, but only when mistakes do not occur. When driving, the

user cannot manually tap the button to indicate the command is over or cancel a command. It is inefficient because it is more likely to cause errors with background noise.

Comparative Study

The following section covers all the comparisons between the Siri voice interface and the other top competitors Cortana and Google Now based on the evaluation criteria provided in the previous section.

1. Cortana

In general, Cortana and Siri have about the same look in terms of their user interface. Siri has a simple interface with a button at the bottom center of the screen as shown in **Figure 4**. Cortana also has an interface of similar style but the bottom of the screen has a textbox and a button appended to the right of the textbox as shown in **Figure 5**.

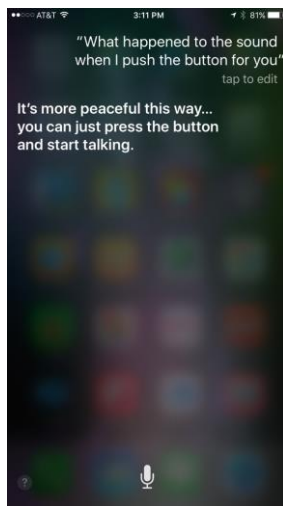


Figure 4. Basic User Interface of Siri on iPhone

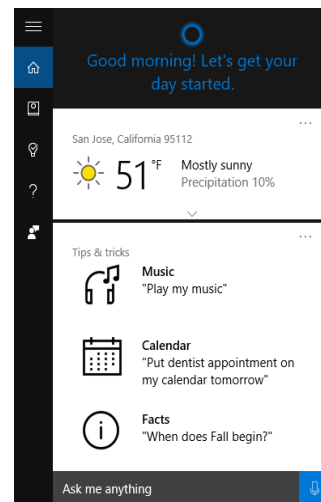


Figure 5. Basic User Interface of Cortana on Windows 10 platform

In terms of interaction with the user, Siri responds to queries by the user through a series of events: user speaks command through microphone, Siri evaluates the noise in the environment, command is received, conversation between user and Siri is printed on screen, and then Siri executes command if command was understood. Cortana does basically the same thing as Siri. The problem with both Cortana's and Siri's feature is that it is not effective on users who have trouble speaking at a pace that either voice interface can keep track of such as slow speaking users.

Also like Siri, Cortana works in any environment that the user is in. Whether the environment has internet connection or not, the voice interfaces can evaluate and execute some commands. One big problem that users encounter is the noise levels in their environment.

The problem here is that if a user is in a noisy environment, both Siri and Cortana have a hard time knowing when the user has finished speaking a command. In other words, users have to be in low noise environments if they want to get more tasks done using voice.

2. Google Now

Google now has its own unique interface that is just a test box that is integrated in the top of your smart phone launcher main screen. **Figure 6** below a picture of the user interface.

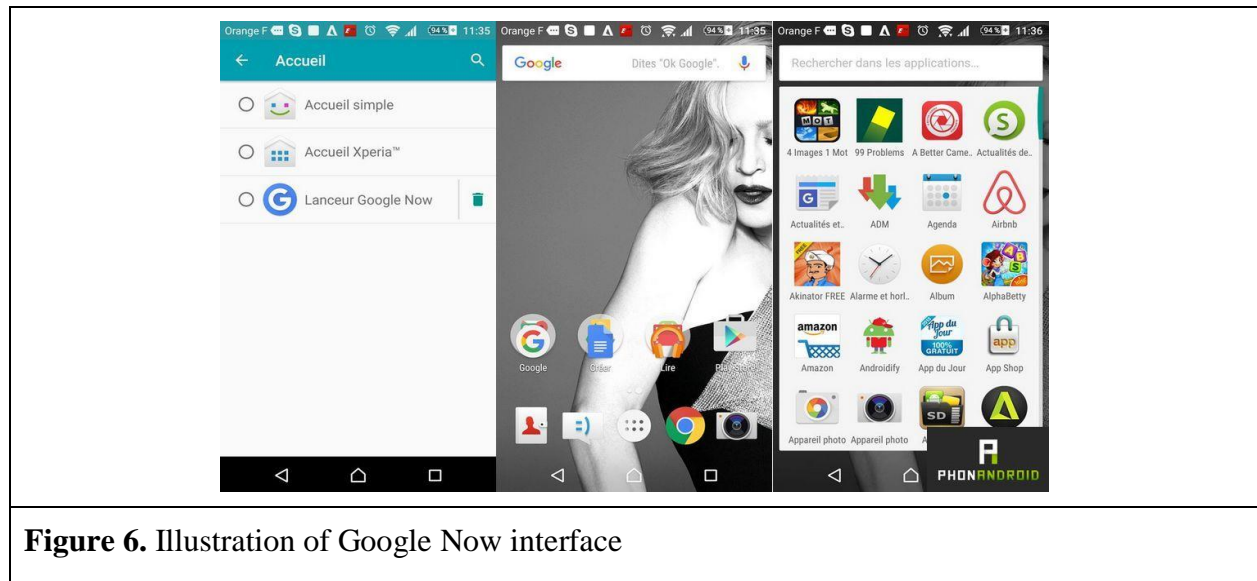


Figure 6. Illustration of Google Now interface

Google Now interface requires that you either activate the software by saying “ok google” or clicking on the microphone icon to use google now. When Google now has been activated it makes a single ringing sound. **Figure 7** illustrates how the activation of “Ok Google” works. After you hear the first ring sound a window opens up with a sound icon and text that says “listening” this is when you can ask it what you want to search, and after you make your request, you hear a second ring sound. For the most part we notice that the Google now software is able to pick up your voice, regardless of your ascent, speed of talking, and the tone of voice except for some occasions which we will further explain. When Google now fails to complete your commands, the failures are inconsistent.

Also, Google now’s hands free mode has some issues. The voice interface is able to pick up when the user says “Ok google.” The problem with that is the phone can never be in locked mode because then the wake up command doesn’t work. Also, after every command processed through voice activation, Google now is inconsistent in terms of when the user can activate the voice interface with voice again. Most of the time, the application that is opened when Google now is activated has to be closed for voice activation to work. Overall, like the other voice interfaces, Google now is inconsistent with its listening state, error tolerance is not handled very well including in noisy environments, and problems with hands free mode makes it partially unsuitable for completing tasks without the use of its touch interface.

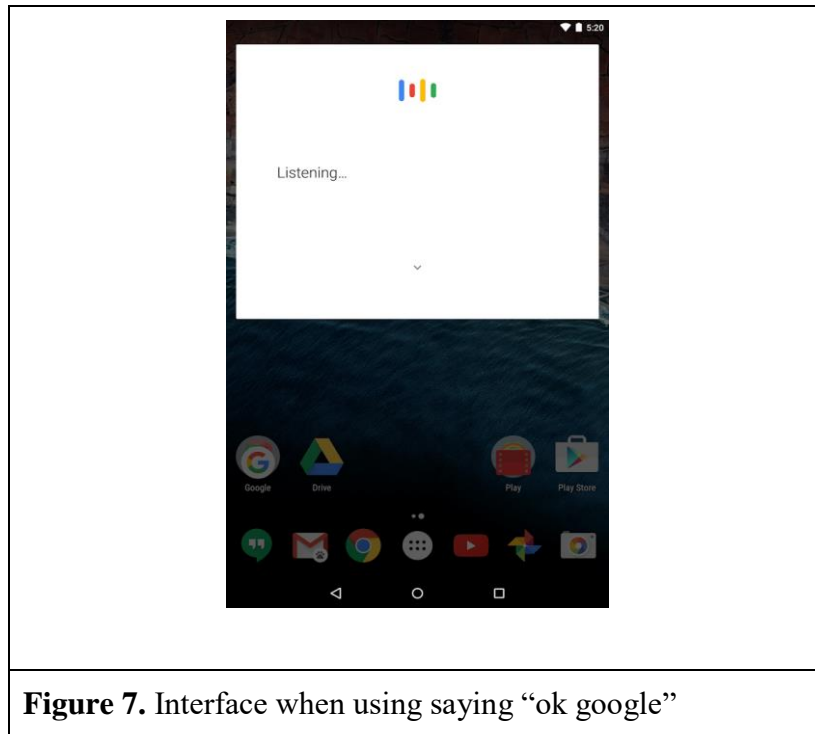


Figure 7. Interface when using saying “ok google”

User Profiling:

Determine the target audience and define user profiles

For the Siri interface, our targets for the evaluation and new features are advanced users, users who speak slowly and/or recall information quickly, hands free mode users, users whose accents are difficult for Siri to process, and users who often deal with a lot of background noise. The following user profiles demonstrate the targets for our design.

Users who speak slowly and/or recall information quickly:

Name: Alexander Rhodes

Scenario:

Alexander presses the microphone button inside the Siri application. Alexander speaks the following command: “Text Frank to ... get ... a hundred G ... I Joe’s ... ready for the next shipment ... end.” Siri shows Alexander the text he wants to send to Frank and asks Alexander if he wants to send the message. Alexander replies, “yes end.”

Description:

Alexander Rhodes is a 34 year old man who lives in Dallas, Texas with his wife and newborn daughter. Alexander was diagnosed with small symptoms of Aphasia which affects his speech. Since he was diagnosed, Alexander is only able to speak his sentences very slowly. Despite his slow speech problem, Alexander is one of the managers at a toy manufacturing company.

Characteristics:

Alexander is determined, charismatic, smart, and proactive. He is small but he always makes himself heard even if he takes a while to speak his sentences out loud. He is always striving to make his speech better but he becomes irritated when his speech hinders him from accomplishing his tasks.

Reasons for Using Application or Device

Alexander's department is very big so he wishes to send messages to the members of the teams that he manages from wherever he is. Although he is able to text them directly, he wants to use his voice to get the job done, but he only has an iPhone and has some experience using Siri.

What they are interested in:

Alexander is interested in making his job as a manager worthwhile and effective such that he has more time to spend with his wife and daughter. He likes to go on walks around the city and be surrounded by all the sounds of a big city. He also likes to hang out with his co-workers and spend time with them watching Dallas's hockey team The Stars play at the American Airlines Center.

What they are looking for:

Alexander is looking for Siri to improve its listening skills to meet his speech problem. Since Alexander has a hard time speaking at a pace that Siri can understand, it becomes frustrating for him. Though he currently texts to all his team members, he wishes to be able to get that done using voice instead since it not only helps him improve his speech but it lets him do any other tasks without the need of typing things on his phone.

Web Experience and Expectations

Alexander has a lot of web experience since in college that is all he spent his time doing when he didn't have class work or job priorities. He knows how to search and customize his web experience easily. Though his intentions for using the app are not necessarily related to the web, for his own personal use, he does expect that web searching with Siri works well when only voice is used as input.

Tasks

Alexander wishes to get the following goals complete by using Siri:

1. Send text messages to all team members whenever there is an expected shipment using his voice with no more than three tries to get it done
2. Perform quick web searches through Siri without having the system interrupt the intake of a command by speech to stop in between

Advanced Users

Name: Ali Kumar

Scenario

Ali Kumar is just got out of his computer science class and is about to go to work and helps himself and his friends order tickets to see Batman vs Superman by saying "Siri check the movie times for Batman vs Superman". Then Ali Kumar says "Order 8 tickets from AMC 20 9:30PM" and his friends all send him money for the tickets to his Ali's google wallet using the google wallet app.

Description

Ali Kumar is a Fremont High school student and works who is a heavy app user smartphone and uses their smartphone to save time to go to a top college.

Ali Kumar has some significant experience using Siri and from previous experience has made the advanced user want to research and understand how to use Siri better. He is a heavy technology users may have some experience using Siri in there car, are young early adopters of new technology, and have a high school or college education, probably a male. These user can also set up their phone where they can quietly by whispering using their voice in office mode.

Tasks

Ali Kumar has gone beyond making the several commands defined within Siri interface. He have learned to swiftly make commands inside other apps downloaded in apple store by using Siri and uses these apps to save time. For example advanced user can order movie tickets in fandango quickly using the Siri interface if it's used and set up properly ahead of time show in

These users can also customize and use commands in other browsers using url schemes in internet browsers and command them to open up using Siri.

What the user is interested in

Ali Kumar is a top student who is interested in math and science and loves technology.

Characteristics

Time conscious, tech savvy, smart consumer, and enjoys keeping up with the new technology that is being released. He really appreciates convince to help him deal with his busy life like many of the millennials that are around his age and he enjoys tools that make his job a lot easier.

Reasons for using application or device

He is a highly mobile person who wants to have information delivered to him when he wants on his personal time. He loves his apple iPhone and uses it to make decisions fast or while he is on the go.

Web Experience and expectations

These advancers users use Siri to quickly solve problems, check information online, and they built their skill up to level where the. Ali Kumar expects that he can enjoy online shopping often to save time and money using the apps that are compatible with Siri. Ali Kumar uses Siri to study and get homework done in slightly environments. He expects that he can search the web quickly and accurately without issues from surrounding environment.

Users who often deal with background noise:

Name: Brad Hanks

Scenario:

Brad presses the microphone button inside the Siri button while he is at a construction site. He says, "Text Mark that it is raining and the workers have stopped working for the day." Siri displays the text on the screen and asks Brad if he wants to send a text message with the given content, and Brad replies, "yes."

Description:

Brad is a 45 year old construction manager. He has his phone on him at all times while working on construction websites and needs to use it for clear communication.

Because he is on a construction site, he is often surrounded by loud background noises, and this even extends to him driving between sites throughout the day.

Characteristics:

Brad is very hard-working and expects excellence both from himself and the workers that he is managing. He is very concerned for all of their safety and works as hard as he can to meet deadlines. While he's working, Siri does not always properly understand his commands due to background noise, which frustrates him.

Reasons for Using Application or Device

Brad's job is heavily dependent on quick, clear, effective communication so he uses Siri to send messages to coworkers and his own managers. He wants to use his voice to be able to do his job, as he is often juggling several tasks at a time and it makes his job that much easier.

What they are interested in:

Brad is interested in making his life as a manager more effective. He wants to be able to effectively communicate using modern technologies and he doesn't want Siri to make that difficult for him. He works early hours and as a result, he doesn't want to have to deal with technology that doesn't work how he wishes.

What they are looking for:

Brad wants Siri to be able to properly understand him with all of the background noise going on at a construction site or while he is in the car. Sometimes he needs to get a quick text message out while having to deal with another situation, so using voice to text makes that easier for him.

Web Experience and Expectations

Brad is not an expert on the web and uses technology for its basic functions. He uses his phone to text, email, and call and he wants there to be a small learning curve and a large payoff.

Tasks

Brad wishes to accomplish the following goals by using Siri:

1. Send a text message in less than three tries.
2. Send an email in less than three tries.
3. Make a call to someone in one try.

Hands free mode users:

Name: Shawn Ross

Scenario:

Shawn has already configured Siri settings to acknowledge him whenever he says "Hey Siri". While driving, Shawn has his phone on the passenger's seat and says, "Hey Siri" to initiate Siri to listen. Siri acknowledges, and Shawn proceeds to say a command, "Text my wife 'How are you today?'"

Description:

Shawn Ross is a 40 year old trucker who drives 11 hours per day. For his and everyone else's safety on the road, Shawn must not use his iPhone's touch interface while driving. Therefore, Shawn uses Siri's hands-free mode the majority of the day as he can send his family text messages or do other various tasks while driving.

Characteristics:

Shawn's main focus while driving is the road and traffic around him. He has been driving for many years so he is considered a great multi-tasker while driving. He often can shift part of his focus to interact with Siri to entertain him while driving. Because he uses Siri daily, he believes Siri can improve its hands-free mode usability.

Reasons for Using Application or Device

Shawn uses his iPhone as his work and personal phone. He uses it to send emails, text messages, route to local businesses, set reminders, and play music. He likes to use Siri because of the hands free mode, which allows him to focus on driving and have his hands on the wheels. Using Siri hands free mode, Shawn can complete his tasks without using his hands.

What they are interested in:

Since Shawn uses Siri daily, changes that improve efficiency and effectively shall will have a tremendous effect on his overall experience. Any errors and frustration while using Siri can have a potential to distract him on the road. For everyone's safety, Shawn wishes to minimize the risk furthermore.

What they are looking for:

With the improved usability for Siri, Shawn can seamlessly go by his day without any frustrations and errors. Shawn is looking for enhancement that will complete his tasks faster with less errors.

Web Experience and Expectations

Although Shawn uses his iPhone and Siri every day, he is not very technologically oriented. He is considered an intermediate user. He understands the uses of Siri for his own interest, and is smart enough to figure out any advanced settings if needed. He expects that the use of Siri to continue to remain the same, simple, so he can effectively accomplish his tasks.

Tasks

Shawn wishes to accomplish the following goals by using Siri:

1. Send text messages to his family in less than two tries.
2. Find directions to a location in less than two tries.
3. Create reminders and calendar events in less than three tries.
4. Make a call to someone in one try.

New Design User Requirements

The following are all the requirements for the Siri update as discussed in the evaluation section.

I. Users shall configure a custom voice input to end the task in Settings

The user can go to the settings inside the Siri interface, click on the option "end tasks manually," and change the word which lets the voice interface know when to end task that will terminate Siri's listening state.

II. Users shall configure a custom voice input to cancel the task in Settings

The user can go to the settings inside the Siri interface, click on the option “cancel tasks manually,” and change the word which lets the voice interface know when to cancel tasks that the user does not want the interface with a custom word of the user’s preference.

III. Users shall have the ability to turn on or off the “end” input in Settings

The user can go to the settings for the Siri interface and toggle the option “end input”. When the option is toggled on, the end input is active and when the option is toggled off, the end input is inactive.

IV. Users shall have the ability to end a command anytime using the custom voice input

The user can use their customized voice input in order to end a command. Siri will recognize that the end command has been given and stop listening at that point.

V. Users shall have the ability to cancel a command anytime using the custom voice input

The user can use their customized voice input in order to cancel a command. Siri will recognize that the cancel command has been given and cancel the action that she was to take.

VI. Hands free users shall not need to confirm a voice command task.

The advanced users can toggle “Hey Siri” for hands free mode. Siri will recognize if user is in hands free mode before executing the command.

Usability Metrics for Siri Update Design

Below is the table for the usability matrix in regards to the Siri update.


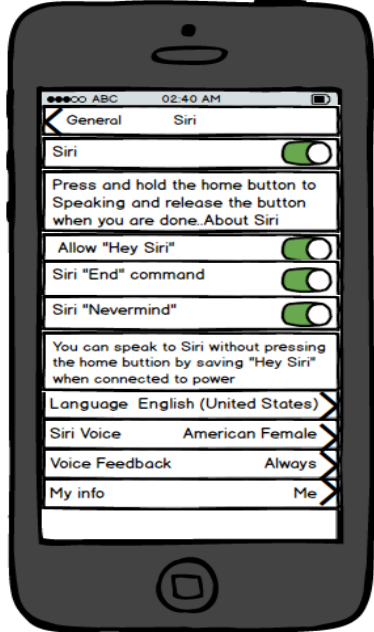
Table 1. Usability Criteria evaluation table along with the metrics for each criteria

Usability Objective	Usability Metrics		
	Effectiveness	Efficiency	Satisfaction
Consistency	Number of unresolved commands out of 10 voice commands attempted	Average time taken for voice recognizer to respond out of 10 total tasks	User satisfaction with consistency of new commands out of 5 stars
Error Tolerance	Number of errors handled successfully out of 10 voice commands attempted	Average time spent on correcting an error out of 10 errors	User satisfaction with error handling out of 5 stars
Suitable for Hands free mode	Number of miscued “end” of listening state commands out of 10 tries	Average time taken to respond to “end” or “never mind” command out of 10 tries	User satisfaction with hands free mode out of 5 stars

Conceptual Prototype

Introduction to the conceptual model- The user initially asks Siri a question and then the user says “end” to signal the voice input handler to stop listening. The Prototype is going to have the user interface layout just like the most up to date version of Siri. The application will be used in the same way that has been used. **Figure 8** and **Figure 9** below illustrate the basic conceptual prototype features for the Siri update.

Siri improved Functionality Siri can be used in the same way as it is currently but with the end command, the user will be able to fully control the end of listening state. The user will also have the ability to cancel voice input as he or she speaks by using the “never mind” command. The two commands can be turned on and off by the user using the settings illustrated in **Figure 9**.

 <p>A Balsamiq wireframe of an iPhone screen. At the top, the status bar shows 'ABC' and '01:57 AM'. Below the status bar is a text input field with the placeholder text 'What Can I help you with?'. At the bottom of the screen is a circular microphone icon.</p>	 <p>A Balsamiq wireframe of an iPhone screen showing the Siri settings menu. The status bar shows 'ABC' and '02:40 AM'. The menu is titled 'Siri' and includes the following options: 'Siri' (with a toggle switch), 'Press and hold the home button to Speaking and release the button when you are done. About Siri', 'Allow "Hey Siri"' (with a toggle switch), 'Siri "End" command' (with a toggle switch), 'Siri "Nevermind"' (with a toggle switch), 'You can speak to Siri without pressing the home button by saying "Hey Siri" when connected to power', 'Language English (United States)', 'Siri Voice American Female', 'Voice Feedback Always', and 'My info Me'.</p>
<p>Figure 8 Balsamiq model of Siri app main screen</p>	<p>Figure 9 Balsamiq Model of Siri Settings menu</p>

Along with the new commands and before activating each one of them, toggling the command buttons on will trigger a set-up screen almost like the one that Siri already uses for the allow “Hey Siri” wake up command. This time, the “end” and “never mind” commands will have their own personal one which allows Siri to understand the user’s way of saying the keywords that trigger the commands. In the set-up screen, the user has to say the keyword a total of three times before the set-up is complete. The user will also be allowed to quit the set-up at any time before the set-up is complete.

Conceptual Design Evaluation and Modification

The conceptual design was evaluated using the evaluation criteria described in the interface evaluation section. The evaluation was as follows:

1. Consistency with listening state

Our design includes both a keyword to end the listening state and proceed to the processing state and a keyword to end the listening state and proceed to the idle state because the command has been cancelled. But, since we are only concerned with transitioning from one state to the other, our design meets the expectations because when the commands are toggled on and once the keyword is gathered, the listening state is ended immediately and the next state executed.

2. Error Tolerance

In terms of error tolerance, the “never mind” command takes care of that issue. Anytime the user makes a mistake in his or her speech query or the voice interface makes a mistake, the user can just say “never mind” and the entire speech input is not processed. Once the user has said “never mind,” he or she can restart the process. The only issue here is that the user would have to restart from the very beginning of the listening state. The issue can be inconvenient if mistakes happen often.

3. Suitable for Hands Free mode

With our design, as long as the allow “Hey Siri” command is working properly, there is always a way to handle voice input without the need to use the touch interface. There is one command to turn on the listening state, one command to end the listening state and deliver a result to the user, and another command to handle errors that may arise during the listening state. All of these commands need to be toggled on to make the best use of hands free mode in this case.

Modifications

In order to make it easier for the user to use these commands, we decided to change the visual interface a bit by adding a settings button on the main screen as well as adding all the hands-free commands in one section inside the settings called “Advanced Settings.” In terms of the voice interface, we are also letting the user customize their own “end” and “never mind” commands in order to make the user more comfortable in terms of what words he or she would like to use to end or cancel their input. Not only does this benefit the user, but it also benefits the voice interface because then it knows exactly what the user is trying to say since it becomes accustomed to how the user say his or her keywords.

Interactive Prototype

Tools

To implement the changes needed for this project, we needed to simulate Siri with some Android code as Apple did not create Siri as an open source project. To do this, we used an open source from G Rom at GitHub as our voice recognition engine and designed an application in Java to look and function similarly to Siri. Thus, we used Java code to create our prototype and used Android Studio as our development environment. Android Studio was useful as it allows us to easily create and design applications and test them, either on our on Android devices or on an emulator provided.

Techniques

The goal for the Siri voice interface was to make use of the two new commands: the “end” command and “never mind” command. In order to make the commands fit, we took some typical commands that Siri can interpret such as “call” or “search” and hardcoded the details to simulate what Siri might say when those commands are recognized. Knowing that the Android recognizer can provide speech into strings, we implemented the commands so that when the “end” and/or “never mind” commands are toggled on. Whenever the string is

retrieved from the recognizer, those words are retrieved from the end and a method executed to handle those commands.

Tasks

Our tasks for the prototype include making the “end” and “never mind” commands as part of the advanced features in the settings menu. Along with that, the “end” and “never mind” command toggle buttons must lead to their own respective set-up screens just like how it is done for the “hey Siri” wake-up command. Once the commands have been built as buttons and the set-up screens have been integrated, we test the features to see if the commands can be recognized when speech input is provided.

Usability Evaluation based on your usability Metrics

After creating our first version of the interactive prototype, we evaluated the new features based on the Usability metrics as mentioned in the Usability Metrics section. The results are represented below in **Table 2** and **Table 3** in the appendix has all the data used to get these results.

Table 2. Usability metrics and results of evaluation of Siri interactive prototype

Usability Objective	Usability Metrics		
	Effectiveness	Efficiency	Satisfaction
Consistency	3/10 unresolved commands	5 seconds taken on average for voice recognizer to respond out of 10 total tasks	Average of 3/5 stars
Error Tolerance	9/10 errors handled	3.5 seconds spent on average correcting an error out of 10 errors	Average of 3/5 stars
Suitable for Hands free mode	1/10 of miscued “end” of listening state commands	Average of 2 seconds taken to respond to “end” or “never mind” command out of 10 tries	Average of 4.1/5 stars

All metrics testing was done on an Android device. By saying the same command ten times repeated, the team was able to produce data for effectiveness and efficiency metrics. For each usability objective, ten Siri users were asked to rate their satisfaction after trying out the demo. Many enjoy the idea and agree on the effectiveness of the redesign, especially removal of confirmation. Siri currently would require an additional input to confirm, which is not efficient. Removal of confirmation was able to reduce the task time to 2 seconds when user is in hands free mode. Bad ratings and errors were expected due to testing on an unrefined Android app. However, the actual results were better than expected.

Usability Enhancement from Previous Design

A primary focus of the usability enhancement focused on consistency. In the original prototype, commands were not being consistently picked up and as a result, the proper action from the software was not being taken. To improve the consistency, the team worked on the software and improved the speech algorithms to ensure that the command was being picked up and that the appropriate action was being taken. This enhancement also helped to improve the error tolerance of the prototype, as the program can now state when it does not understand a command or dialogue. Furthermore, action was taken to improve the simulation of the software, as it was intended to simulate Siri. This involved altering the visual interface to better resemble the Siri application and also improving the dialogue between the interface and the user to better simulate a dialogue that Siri would have.

Conclusion

This project has been focused on improving a voice user interface. To do this, we simulated Siri with Java code and implemented our desired changes to make the voice interface better to use for our target user profiles. The application adds the “end” and “never mind” commands and returns voice feedback based on what the user had said. There are a few things to conclude as a result of implementing this project. One is that there are many different users that can use voice interfaces, from beginners to advanced. Because of this, it is important to make the interface easy to use for novices, but to also provide advanced users with more interesting features that can enhance their experiences. Another conclusion to be drawn is that there is an overhead for implementing these features. So, while it’s desirable from a user experience standpoint, there is good reason why not all voice user interfaces support the features that we added to improve the user experience.

The result of the project is a simulated Siri application that gives users the opportunity to enhance their experience with the voice user interface. If features such as these were really implemented by Apple, users would be able to really begin to tailor their Siri experience to fit their needs and make their lives easier. With the rise of voice interfaces due to modern technology, this is an important field to explore. Voice user interfaces will see more and more users and as a result, there needs to be a large effort to provide them with the best experience possible.

What did you learn from this project

- Creating a voice interface is difficult.
- Coding these features was not straightforward, although there are great benefits from a user experience standpoint.
- Expanding the user experience for advanced users is important.
- Designing a user interface that is simple for novices, but allows advanced users to customize their experience is crucial to creating a large user base.
- Creating a good user experience for an up and coming type of interface will help companies and developers in the future.

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Appendix

Below is the data collection for the usability evaluation of the interactive prototype on **Table 3**. The “metric” column abbreviations are expanded on **Table 4**.

Table 3. Data collection for usability metrics on interactive prototype

Metric	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
CEFT	Pass	Pass	Fail	Pass	Pass	Pass	Fail	Fail	Pass	Pass
CEFC	3 s	7 s	6 s	3 s	5 s	6 s	3 s	5 s	5 s	7 s
CSAT	3 / 5	4 / 5	4 / 5	4 / 5	2 / 5	3 / 5	3 / 5	3 / 5	3 / 5	2 / 5
EEFT	Pass	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Pass
EEFC	2 s	2 s	4 s	5 s	4 s	3 s	4 s	3 s	3 s	5 s
ESAT	3 / 5	3 / 5	3 / 5	4 / 5	2 / 5	3 / 5	3 / 5	3 / 5	4 / 5	2 / 5
SEFT	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SEFC	2s	2s	2s	2s	2s	2s	2s	2s	2s	2s
SSAT	4/5	4/5	4/5	5/5	3/5	3/5	5/5	4/5	4/5	5/5

Table 4. Expanded version of the abbreviations for all the usability metrics in Table 3

Abbreviation	Metric Description
CEFT	Number of unresolved commands out of 10 voice commands attempted
CEFC	Average time taken for voice recognizer to respond out of 10 total tasks
CSAT	User satisfaction with consistency of new commands out of 5 stars
EEFT	Number of errors handled successfully out of 10 voice commands attempted
EEFC	Average time taken correcting an error out of 10 errors
ESAT	User satisfaction with error handling out of 5 stars
SEFT	Number of miscued “end” of listening state out of 10 tries
SEFC	Average time taken to respond to “end” or “never mind” command out of 10 tries
SSAT	User satisfaction with hands free mode out of 5 stars