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Universal Language Translator (ULTRA) User Manual

by Christian Schlesiger

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Universal Language Translator (ULTRA) User Manual

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1. Introduction

The Universal Language Translator (ULTRA) application is a Speech-to-Speech translation system designed to run on an Android phone. The application is intended to be used in the field to assist in communication with foreign nationals when human translators are not available.

The ULTRA application works in several steps using Android services on the phone to recognize speech, translate it to a foreign language, and then synthesize that translation into speech in the other language. The application works in both directions, from the foreign language into English and from English into that same foreign language. This allows for rough two-way communication to conduct simple interviews, for example.

All recordings and transcriptions are saved on the device for later retrieval, reporting, and analysis. Settings within the application manage where they are saved and how much history to retain.

The application also can display its prompts and user interface in both languages to allow the foreign national the user is interacting with to understand what the application is doing and how they can participate in the process of communicating across the language barrier.

The application is launched on the Android phone like any other application.

2. Permissions

The ULTRA application requires two permissions to be enabled by the user the first time it is launched on the device. Once permission has been granted, it will not be necessary to grant it again in the future.

The first is permission to use the phone's microphone. This must be enabled to allow the application to record speech to translate. The second is permission to read and write files to the phone's storage. This is necessary to save the translation history for later retrieval. If these permissions are not granted, then the application will display a warning screen to that effect and not allow the user to proceed to the main screen.

3. The Main Screen

The main screen is where most of the operations will take place (Fig. 1). The top portion of the screen is a list showing the translation history ordered with the most

recent translations at the bottom and the oldest scrolling off the top. The list is scrollable so one can refer back as needed.

The bottom section of the screen is where the activity takes place. One can see at a glance what language pair is currently selected, replay the currently selected translation history item, initiate a new speech-to-speech translation, go to the Settings screen to change how the application operates (including changing the selected language), and go to the information screen to see logs of activity and greater detail about what is happening under the hood of the application.

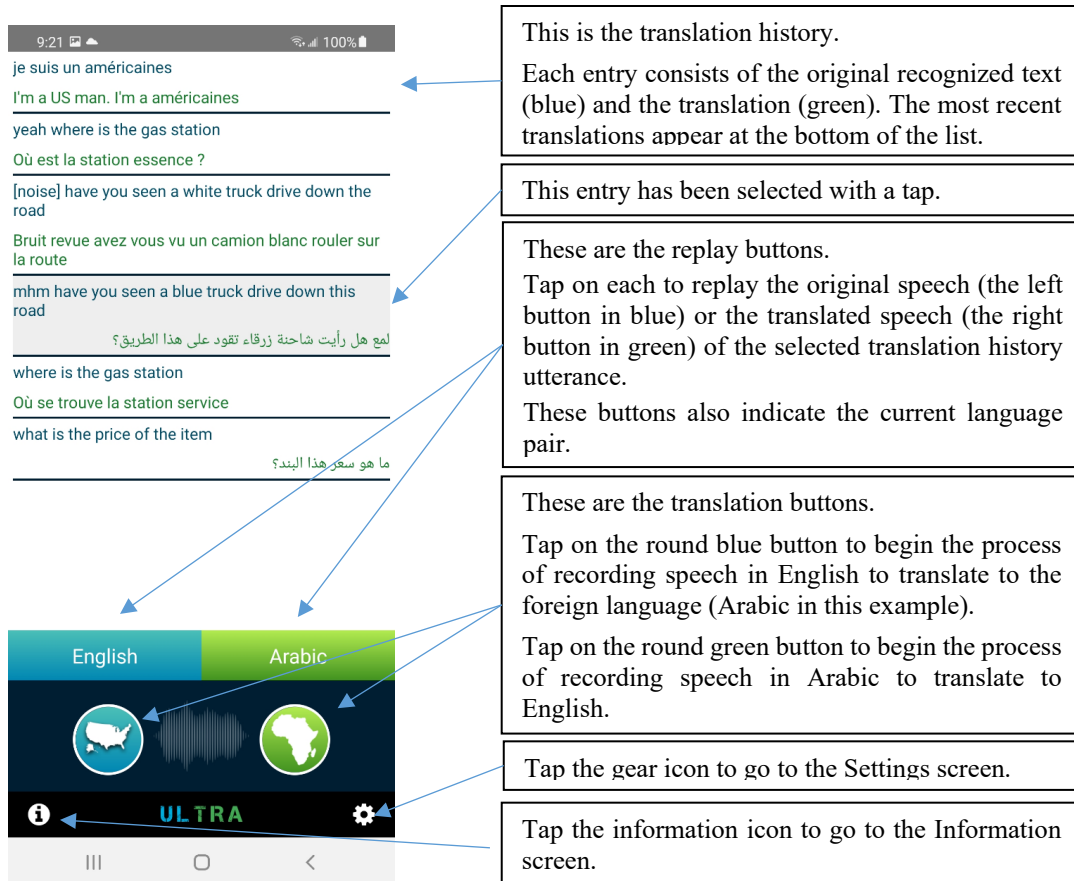


Fig. 1 Main screen of the ULTRA application

4. Initiating Speech-to-Speech Translation

To start a new utterance, simply tap the round button on the main screen of the original language to be spoken. If you are speaking English, tap the blue round button on the left. If the foreign national is speaking in his native tongue, tap the green round button on the right.

The screen will change to the Recording screen showing a microphone icon (Fig. 2). There are two buttons on the bottom. Speak a sentence in the appropriate language and tap the green Translate button to continue. If you are not satisfied with the recording, tap the blue Cancel button to cancel the process.

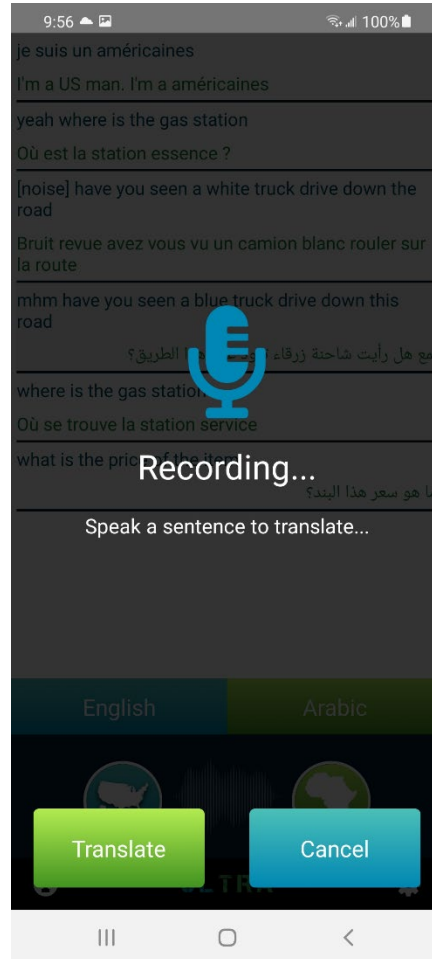


Fig. 2 Speech recording screen

The time it takes to translate a spoken sentence can be several seconds. Please be patient.

As the application processes the recorded speech, it will show progress. First, it will convert the language you just spoke into written text, then it will translate that text to the other language in text as well, and then synthesize that text into a new speech recording (Fig. 3).

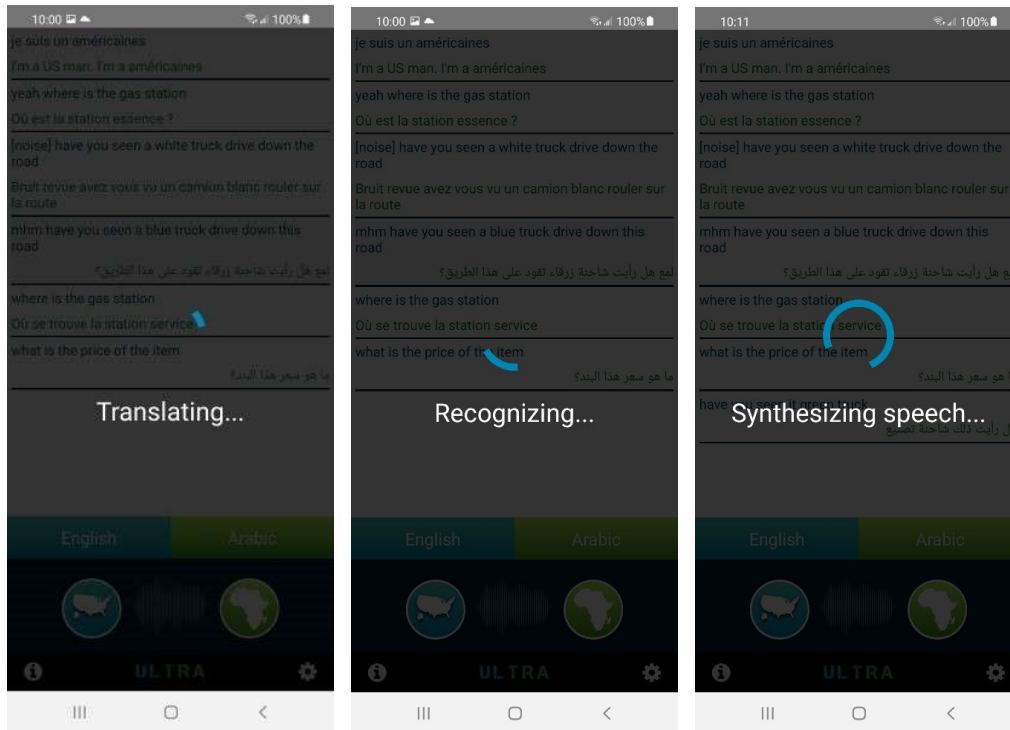


Fig. 3 Progress screens showing each step

When the process is complete, it will play back the translated speech through the phone's speaker. The new utterance will be added to the bottom of the translation history list.

5. Reviewing Translation History

The translation history is a scrollable list of utterances with the oldest on the top and the most recent on the bottom. This allows the most recent translation to be displayed prominently in the center of the screen. After each new translation, the history scrolls up.

The original text is displayed first on the top of an entry in blue. This text is what the automatic speech recognition (ASR) component of ULTRA determined was said in the recorded speech. The user can easily refer to the utterance text to determine if it accurately recognized what was said.

Below that is the translation of the utterance into the foreign language displayed in green text. This translation was created by the machine translation (MT) component of ULTRA.

The ASR, MT, and text-to-speech (TTS) components used for the utterance in the list depend on what foreign language was selected at the time of recording and

processing. This may be different in the history than what is currently selected for processing. For example, the history may show a translation from English to African French, but the application is currently configured to do translations from English to Libyan Arabic.

Selecting a translation history utterance to interact with is achieved by tapping it in the list. The currently selected entry is highlighted in gray.

To replay the originally recorded text, tap the blue rectangular button on the left below the translation history list. This button usually displays “English” but is meant to represent the original speaker’s recording before translation. For an entry in the history that was originated by the foreign national, this same blue button will play their originally recorded text.

To replay the synthesized translated speech, tap the green rectangular button. This synthesized speech is produced from the translated text by the TTS component of ULTRA. The synthesized speech can be compared to the translated text displayed on the screen for accuracy.

Each entry in the translation history list has an associated mini-menu. To reveal the menu, swipe the entry to the left. This will reveal two buttons (Fig. 4):

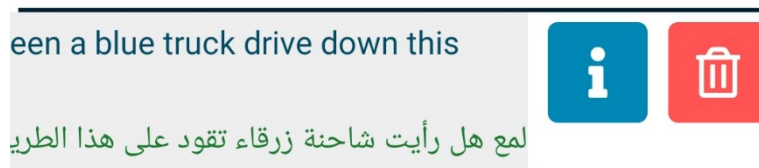


Fig. 4 Translation history mini menu revealed

Tap the red trash-can icon to immediately delete that entry from the list and its associated files saved in the history folder. There is neither a confirmation nor an undo for this operation.

Tap the blue information icon to see detailed information about this translation entry in the history. To return from the Translation Information screen, use the back button or the back arrow at the top left of the screen (Fig. 5).

To close the mini-menu, simply swipe back right on the entry.

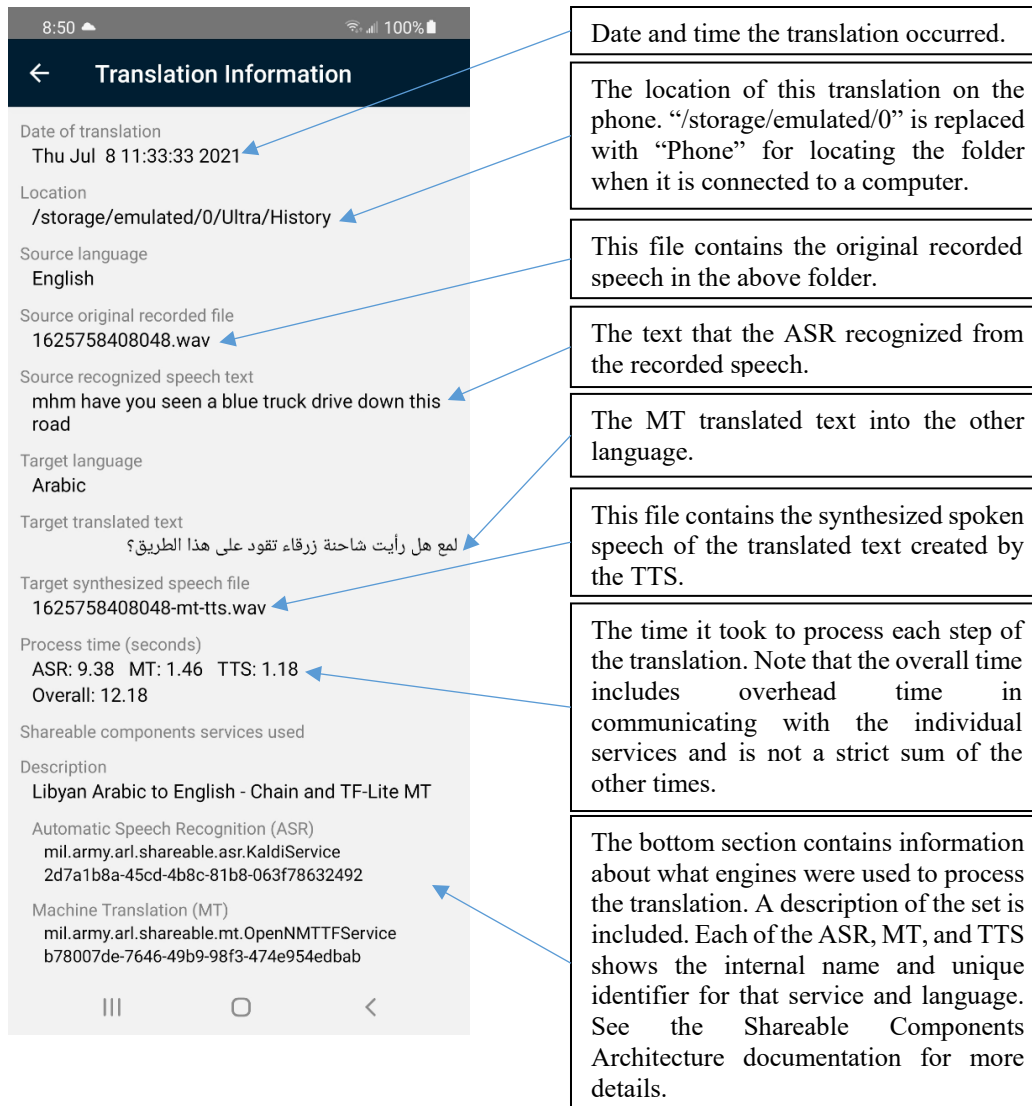


Fig. 5 Translation Information screen

6. Browsing Translation History

The translation history folder may also be browsed with a file management application on the phone, or while the phone is connected to a computer, with the computer's file management programs.

The default translation history folder is located at:

Phone/Ultra/History

The current translation folder can be changed in the Settings screen to any folder on the phone that is writable.

In the folder, each translation consists of three files. These three files all start with the same name, which is a long number. This number is the time in milliseconds (since January 1, 1970) that the translation took place. Thus, files in the folder with a smaller number are older than files with a larger number. Also, it is likely that this name will be unique since it is difficult (an extremely low probability) to have two different translations occur at the same exact millisecond.

The files are as follows (using “1625679052145” as an example):

- 1625679052145.wav – The original recorded speech of the first speaker.
- 1625679052145.yml – Contains all the pertinent information about the translation, including the text, how long it took, and what engines were used to process it. This is the same information displayed in the Translation Information screen shown in the previous section.
- 1625679052145-mt-tts.wav – The synthesized translated speech in the other language.

If a translation is to be copied to a new location, all three files should be moved together. Similarly, if a translation is to be deleted, all three files should be deleted at the same time.

Note: Moving or deleting files from the current translation history folder should take place when the ULTRA application is not running at the same time. The next time ULTRA is launched, it will refresh its view of the current translation history folder.

If there are .wav files present that do not have an associated .yml or -mt-tts.wav file, then these are the result of a translation that did not finish processing. This could be because of an error or a cancellation that did not fully get cleaned up by the system. It is safe to delete these stray orphan .wav files at any time.

7. Settings Screen

To change the settings of the application, tap on the gear icon on the bottom right of the main screen.

7.1 Language

The current language and its description are shown on the main Settings screen (Fig. 6). Tap on Settings to bring up a list of available languages to choose from. Select the language you wish to translate to and from to change the currently selected language.

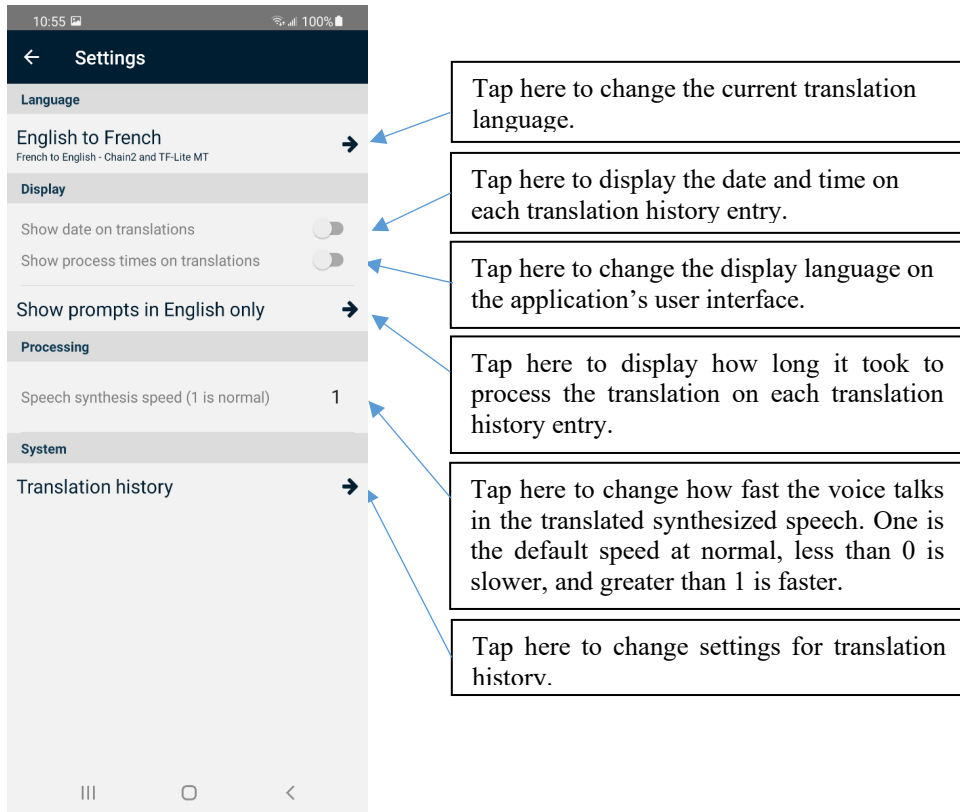


Fig. 6 Main Settings screen

7.2 Display

When you turn on the option to show the date, each entry in the translation history list will also display the date and time when the translation occurred (Fig. 7).

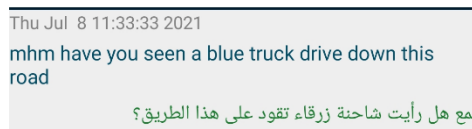


Fig. 7 Translation history entry showing date and time

When you turn on the display for processing times, each entry in the translation history list will also display the time in seconds it took to process the ASR, MT, TTS, and the overall time to translate and create the synthesized speech. This will be added to the bottom of the entry (Fig. 8).

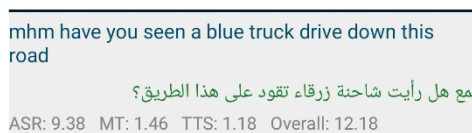


Fig. 8 Translation history entry showing processing times

Turning on both options will display more information on the main screen but will take up space, and thus fewer translations in the history can be seen on the screen at the same time.

There are three choices for displaying language prompts in the ULTRA application, and they are changed by tapping on the current prompt choice and the right arrow next to it. The choices are:

- 1) Show prompts in English only
- 2) Show prompts in source language
- 3) Show prompts in both languages

When the prompts are displayed in the source language, all references to the target language are displayed in that language instead of English (Figs. 9 and 11).



Fig. 9 Main screen when showing prompts in source language

This includes all recording prompts and progress screens that go from the target language into English. This can be helpful in allowing the foreign national to understand what the application on the phone is doing.

The prompts will remain in English when translating from English into the foreign language.

When the prompts are shown in both languages, both languages appear in all prompts no matter which direction translation is occurring (Figs. 10 and 11).



Fig. 10 Main screen when showing prompts in both languages

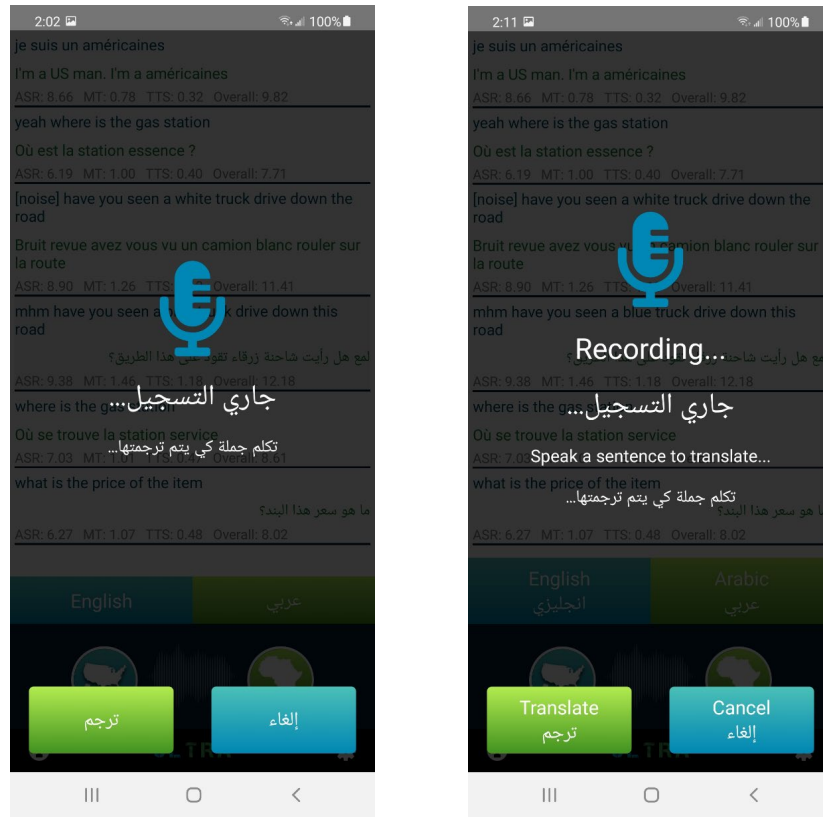


Fig. 11 Progress screens when showing in source (left) and both (right) languages

7.3 Processing

The TTS component can generate speech at varying speaking speeds without altering the pitch. This can be useful, especially when careful enunciation is desired. In most cases, this setting should be left at 1.

If slower speech is desired, set the value to a decimal number less than 1. However, note that slower speech requires more processing time. The system will not allow a value of zero. As this setting is put at a value closer to 0, the application may become unstable. Please use caution.

If faster speech is desired, set the value to a value larger than 1. Setting it to a value larger than 10 will result in speech so fast it will be unintelligible. Again, use caution when changing this setting.

7.4 Translation History

Selecting the translation history option will bring up another screen dedicated to options related to managing past translations saved on the phone (Fig. 12).

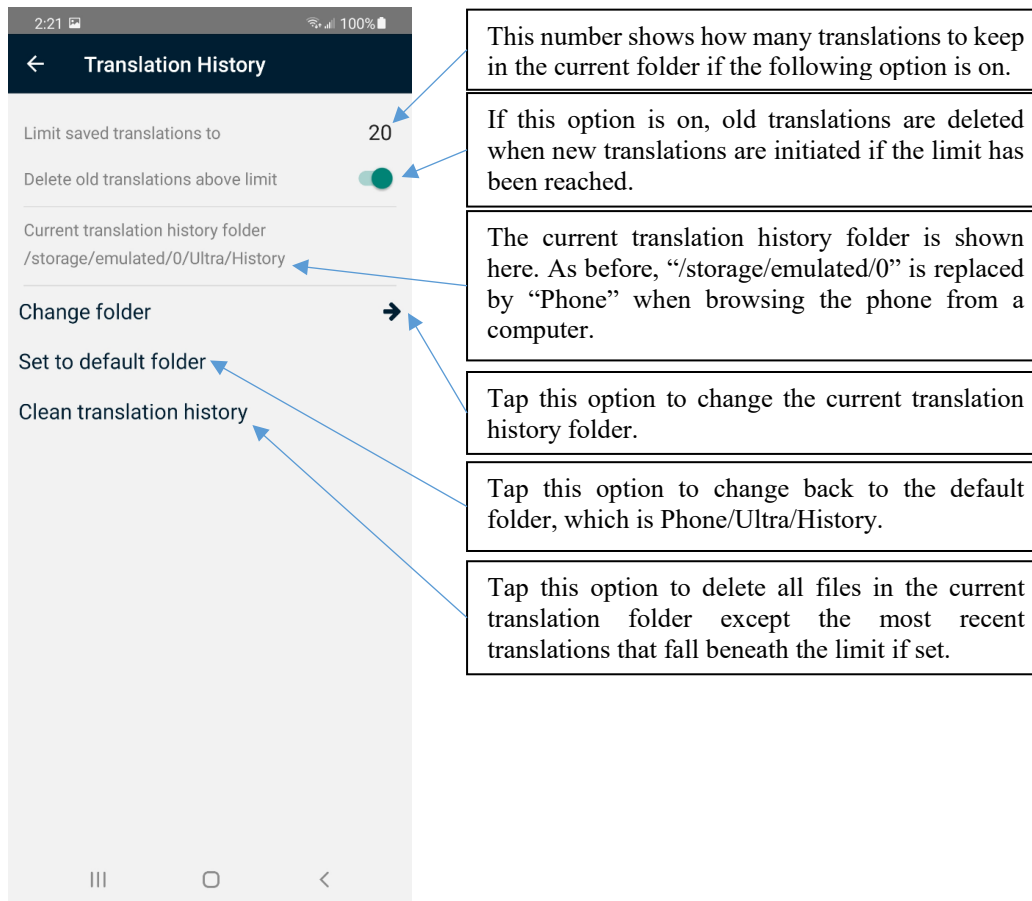


Fig. 12 Translation History options screen

The ULTRA application by default limits the number of translations kept in the current translation history folder to 20. If there are that many translations already present in the folder, when a new translation is conducted, the oldest translation is deleted to make way for the new one.

On the Translation History options screen, that default number of 20 can be changed to any number desired. Also, one can switch off that limiting behavior and keep all translations saved. Caution should be exercised as this folder can grow in size quickly and fill up the phone. Regular cleaning of the translation history folder(s) should be conducted if the limit feature is turned off.

ULTRA has a default translation history folder location found at

Phone/Ultra/History

If that folder does not exist when a translation is initiated, it will be created. On the Settings screen, one can change the current translation folder to any folder desired as long as there is permission to read and write to it.

As a strategy for using the application, one can create a series of translation history folders, perhaps related to the day and location of a field visit. One can simply change the location of the translation history folder as needed by subject, time, location, and so on, as the mission requires and progresses through its lifecycle.

After the mission, or even periodically during the course of it, the phone can then be connected to a computer and all the translations can be organized and backed up for review, analysis, reporting, and archiving.

The option to clean the translation history folder will use the translation limit number set at the top of the screen regardless of whether the limit option is on or off. A confirmation box will explain that the application will delete all files except for the 20 (or whatever number is currently set) newest translations. This option is also useful for cleaning out any orphan translations (see the Browsing Translation History section) that did not finish completely automatically.

8. Information Screen

To view information about ULTRA, tap the “i” icon at the bottom left of the main screen. This screen shows the version information and the development team responsible for the creation of the ULTRA application and the Shareable Components that it uses (Fig. 13).

Below that area is a list of messages generated by ULTRA during the course of its time running. This list is not saved and is refreshed every time the ULTRA application is launched. All activity is logged on this screen, including initiating a translation and changing any setting. If an error arises during the translation process, it will be displayed here.

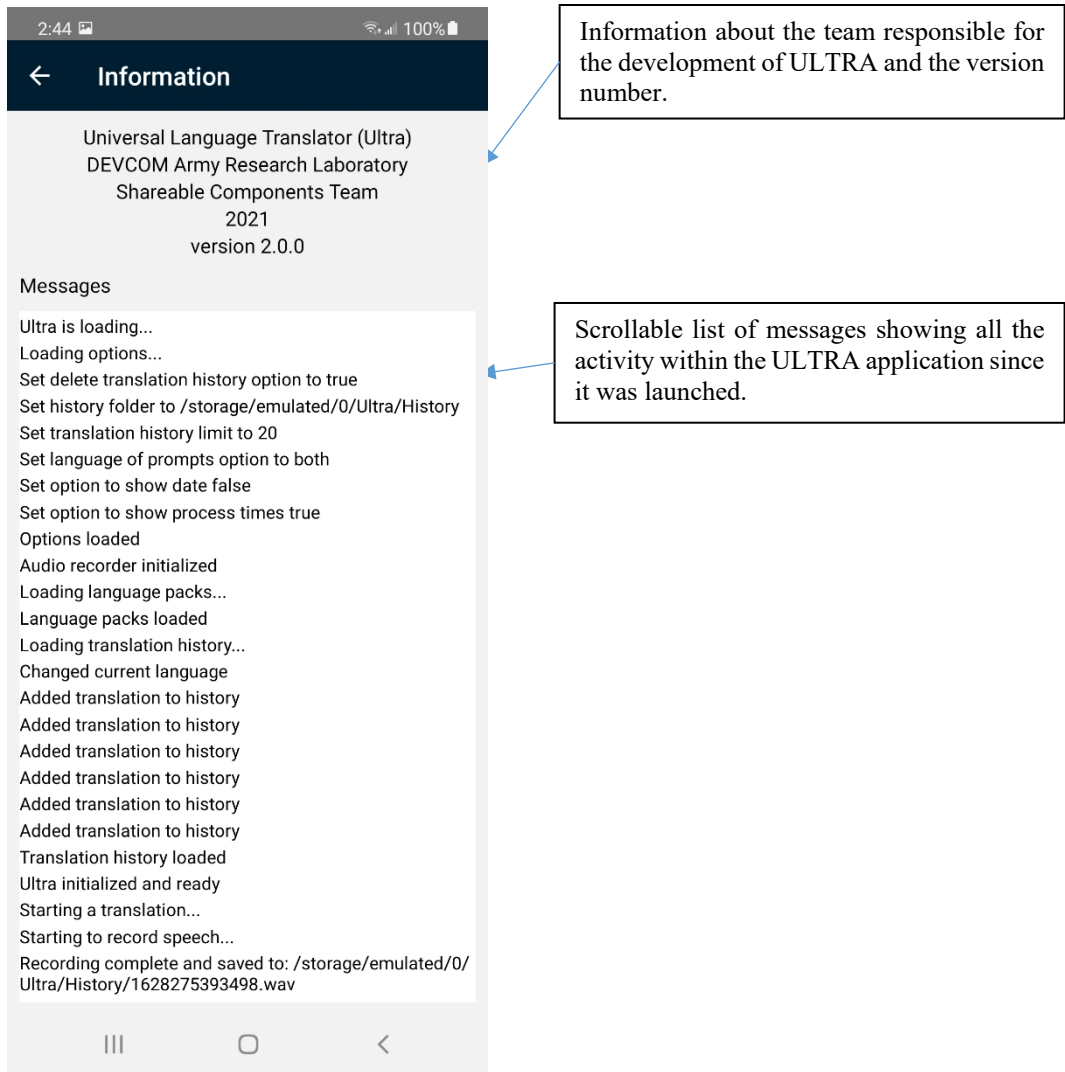


Fig. 13 Application Information screen

List of Symbols, Abbreviations, and Acronyms

ARL	Army Research Laboratory
ASR	automatic speech recognition
DEVCOM	US Army Combat Capabilities Development Command
MT	machine translation
TTS	text-to-speech
ULTRA	Universal Language Translator

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