



Bilkent University

Department of Computer Engineering

CS491 Senior Design Project I

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Lingui: A Personalized Language Learning App Using Videos and Spaced Repetition

Project Specification Document

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1. Introduction

1.1. Description

Most people use the same approach when it comes to learning and teaching new languages: the skill-building approach. This approach is quite intuitive at first, suggesting that you learn the language by consciously learning grammar and applying it when producing output [1]. However, fluency requires more than that: a person must be able to conjugate verbs, choose the correct words, put the words in the correct order, etc. in a very short time, which can only be achieved by acquiring the language. Therefore, we reject the skill-building approach all the other language learning apps and the conventional language learning methods follow and accept a completely different approach: the Comprehensible Input Hypothesis, which can be summarized as follows: “We all acquire language in the same way: by understanding messages” [1].

To speak a language fluently, one needs to effortlessly construct new sentences. This instinct can be developed by acquiring the language, not by consciously learning the grammar rules [2, 3, 4]. Most native speakers do not know the grammar of their native language, despite being fluent in the language. So, we know that fluency is not achieved by learning the grammar of the language. This brings us to our first point: fluency is only possible by developing an instinct for the language.

Learning the definition is not enough to develop an instinct for the words in a language. You also need to see the word in hundreds of different contexts to have a feel for how the word should be used. Every time you hear a word and understand it, the better your instinct becomes, and eventually, you know how the word is used so well that you can use it in your sentences, too. In other words, you acquire the word. Here is our second point: the meaning of a word is acquired when it is seen and understood many times in different contexts.

We did not learn our native language by checking the dictionary each time we heard a word we did not know. We heard it in different contexts, and eventually, we understood the word. After we developed an instinct for the language, we started to speak. You can get the meaning of a word you do not know, or a grammatical structure from context, if you understand the meaning of the overall sentence [1, 3, 4]. To sum it up, the third point is that we can understand the meaning of a word if it is in a sentence where we understand the general meaning.

Lingui combines this approach and the three ideas mentioned. We want our users to watch YouTube videos in such a way that the language level of the video is never too easy or too difficult for the user. We will achieve this by tracking the vocabulary of every user. To ensure that the user understands the meaning of an unknown word in context, we want to give the word in sentences that do not contain any other unknown words. After seeing the words in such sentences a certain number of times, a spaced repetition system will be used to test the user if they learned the word correctly, and to retain this vocabulary knowledge.

Our goal is not to teach the users some phrases they can use in situations they encounter. Language books and other language-learning apps already do that. Our goal is something bigger: to make our users fluent.

1.2. Constraints

1.2.1 Implementation Constraints

- Lingui will be developed as a mobile application.
- Lingui will be available on both iOS and Android platforms.
- Flutter framework will be used for mobile application.
- All members will be using VS Code with linter extensions to maintain code quality.
- Git and GitHub will be used for version control and collaboration.
- Backend will be developed with micro service architecture.
- AWS services for databases, gateways, authentication.. will be used for supporting the backend micro services.
- Frontend of the application will contact only a single point for communication with microservices.
- Docker will be used for building, deploying and networking of services.
- Services will be deployed on EC2 instance(s).
- Each service will be put inside a docker container.
- Services can be implemented in any language that the team member developing it is comfortable with.
- For databases, fully hosted database services from AWS will be used.
- General architecture of the project will aim for high availability, low latency and ease of extension for future changes.

1.2.2 Economic Constraints

- Lingui will be free in the first place with running ads to make up for the cloud expenses.
- Algorithms and architecture will aim to stay on free trial of services used in AWS.
- Free libraries and tools will be used.
- The web page of the application will be on the free GitHub domain.

1.2.3 Ethical Constraints

- User data should be in safe hands.
- Users will have multi factor authentication.
- User data will not be shared with third party platforms.

1.2.4 Sustainability Constraints

- User feedback will be considered for future improvements.

1.2.5 Social Constraints

- The main user group of the application will be Turkish students and white collar workers aiming to improve their English skills.

1.2.6 Reliability Constraints

- Since the application will only be used by end users, down time has to be minimized.
- Even though some services may be down, the mobile application will try its best to serve most of the functionality available.
- Mobile application, microservices and modules in each microservice will be tested by end to end testing and unit testing.

1.2.7 Language Constraints

- Mobile application's user interface will be in Turkish.

1.3. Professional and Ethical Issues

- User data will be collected for analytics.
- User data that is not personal may be shared with third party services for better ad integration.
- Licenses of the APIs that are used will be checked.
- Foul words will not be displayed to the user to provide ethical integrity.

2. Requirements

2.1. Non-functional Requirements

- Usability

The UI of the application will be English to provide easy usage across the globe. Also, the user interface has to be very easy to understand both in order to make the user learn quicker and also for better user experience.

- Scalability

Even though the application will start with very few users, it is intended to have many. In this case, the servers must be able to do the complex tasks of video finding for every user separately.

- Performance

Even though our servers will not be finding videos corresponding to the users' "words to learn list" in real time, performance is still an issue. Firstly, the video and the subtitles must be synchronous. Also, the app must have a low response time in order to achieve a good user experience.

- **Efficiency**

Apps with video content can use big amounts of energy. The application must be energy efficient both for the environment and the user device's battery.

- **Security**

Even though the data that this app gathers is not sensitive, it is still user data and needs to be protected.

- **Extensibility**

Even though Lingui will start its lifecycle as a mobile app, it may also have a website and/or desktop application. Also, the app will probably grow with additional features. In order to achieve those, the documentation needs to be systematic and open to change, and platform specific tools should be used as little as possible during development.

2.2. Functional Requirements

Login & Sign Up: Users will be able to sign up to the application by providing an email and password, or using their Google accounts. We will send verification mails to users to prevent bot/spam accounts. Name of the user and language they want to learn will be asked from the user when they sign up. After the user signs up, they will always be logged in to the app from the smartphone they are using. They will be asked to log in again if they sign out, or use a different device to use the app.

Show Profile: Users will be able to see their profile by clicking the profile icon in the navbar. Profile of the user will contain the achievements they got, how many hours they spent on the app, and how many words they have learned.

Watch Video with Subtitles: The main page of the app will be “display video” screen. Also, the user will be able to navigate to that screen from another screen by clicking the video icon from the navbar. A video will be displayed to the user according to the user’s unknown words and their current language level. Our recommendation engine will find that video by analyzing the words the user doesn't know. Sentences in that video will contain a mixture of unknown and known words such that the user will be able to infer the meaning of the unknown words from the context. Also, each video will have subtitles in the language the user wants to learn. While the video is being watched, subtitles of the video will flow at the bottom half part of the screen. The user can tap the words they do not know in the subtitles while the video runs. When a word is tapped, the video will stop and the dictionary meaning of the tapped word will be displayed to the user so that the user can learn the meaning of the word. The user can continue to watch the video whenever he/she wants. Tapped words will be saved to the “unknown words” list, so that they can be taught the user later.

Display Learning Progress: The user will be able to see their individual progress by tapping the “Progress” icon in the navbar. Progress section will mostly consist of the words. Words that have been learned by the user, and words that are unknown to the user will be shown in that section, so that the user can see their overall progression in that language.

Cloze Test: Our program will have a “Cloze Test” section, which users can reach by clicking the test icon on the navbar. In those cloze tests, words that are being learned by the user will be asked, so that the user can reinforce their overall understanding about that word. Sentences that will be asked to the user will be gathered from both the video content and sources like Tatoeba.

Notification System: In order to apply spaced repetition system in our app, the user will be notified according to the learning intervals to take cloze tests about the words they are learning. This notification system will keep the users in contact with the app, and will maximize the retention rates of the words they are learning.

Personalized Dictionary System: The user might want to learn a word that he/she did not encounter in one of our videos. So, the user can enter that word to the dictionary, see its meaning and automatically add that word to its unknown words list. Also, when any word is clicked in that dictionary, its meaning and example uses will be displayed to the user.

3. References

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[4] Ponniah, R. J. (2008). Free voluntary reading and the acquisition of grammar by adult ESL students. *The International Journal of Foreign Language Teaching*, 4 (1) 20-22.