GOCE DELCEV UNIVERSITY, SHTIP, NORTH MACEDONIA

FACULTY OF ELECTRICAL ENGINEERING

ETIMA 2021

FIRST INTERNATIONAL CONFERENCE

19-21 OCTOBER, 2021

TECHNICAL SCIENCES APPLIED IN ECONOMY, EDUCATION AND INDUSTRY

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UNIVERSITY „GOCE DELCHEV” - SHTIP
FACULTY OF ELECTRICAL ENGINEERING

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ЕТИМА / ETIMA 2021

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PREFACE

The Faculty of Electrical Engineering at University Goce Delcev (UGD), has organized the International Conference ***Electrical Engineering, Informatics, Machinery and Automation - Technical Sciences applied in Economy, Education and Industry-ETIMA*.**
ETIMA has a goal to gather the scientists, professors, experts and professionals from the field of technical sciences in one place as a forum for exchange of ideas, to strengthen the multidisciplinary research and cooperation and to promote the achievements of technology and its impact on every aspect of living. We hope that this conference will continue to be a venue for presenting the latest research results and developments on the field of technology.
Conference ETIMA was held as online conference where contributed more than sixty colleagues, from six different countries with forty papers.
We would like to express our gratitude to all the colleagues, who contributed to the success of ETIMA'21 by presenting the results of their current research activities and by launching the new ideas through many fruitful discussions.
We invite you and your colleagues also to attend ETIMA Conference in the future. One should believe that next time we will have opportunity to meet each other and exchange ideas, scientific knowledge and useful information in direct contact, as well as to enjoy the social events together.

The Organizing Committee of the Conference

ПРЕДГОВОР

Меѓународната конференција ***Електротехника, Технологија, Информатика, Машинство и Автоматика-технички науки во служба на економија, образование и индустрија-ЕТИМА*** е организирана од страна на Електротехничкиот факултет при Универзитетот Гоце Делчев.
ЕТИМА има за цел да ги собере на едно место научниците, професорите, експертите и професионалците од полето на техничките науки и да представува форум за размена на идеи, да го зајканува мултидисциплинарното истражување и соработка и да ги промовира технолошките достигнувања и нивното влијание врз секој аспект од живеењето. Се надеваме дека оваа конференција ќе продолжи да биде настан на кој ќе се презентираат најновите резултати од истражувањата и развојот на полето на технологијата.
Конференцијата ЕТИМА се одржа online и на неа дадоа свој допринос повеќе од шеесет автори од шест различни земји со четириесет труда.
Сакаме да ја искажеме нашата благодарност до сите колеги кои допринесоа за успехот на ЕТИМА'21 со презентирање на резултати од нивните тековни истражувања и со лансирање на нови идеи преку многу плодни дискусии.

Ве покануваме Вие и Вашите колеги да земете учество на ЕТИМА и во иднина. Веруваме дека следниот пат ќе имаме можност да се сретнеме, да разменime идеи, знаење и корисни информации во директен контакт, но исто така да уживаме заедно и во друштвените настани.

Организационен одбор на конференцијата

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PROPOSED MODEL FOR BETTER ENGLISH LANGUAGE ACQUISITION, BASED ON WEARABLE DEVICES

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Abstract
A solid English Language comprehension is a necessity in today's technology driven world. Furthermore, the significance of the English Language is only amplified by its presence in modern higher education. This paper presents a smartphone and wearable device oriented language learning model which can be used both during and after lectures. The model intents to gradually enrich the students' English language vocabulary as they proceed further with their lectures. Additional features are designed to help students improve their pronunciation of the newly discovered words. A key point that makes this model efficient is that students can advance their vocabulary and pronunciation skills paralleled with their study subjects.

Key words
Language learning, Blended Learning, English vocabulary app.

Introduction

It goes without saying that the most of the available literature, that can be easily accessed today, is written in English. Furthermore, the English Language is well known for being present in every branch of science and technology, especially when it comes to scientific terms and engineering vocabulary. Establishing itself as one of the most widely spread languages across the world, it induces one's necessity for a certain level of language proficiency.
Fluency in English is not only needed because of its significance in the exhaustive study of any subject, but also for conducting research, different forms of formal communication, job interviews, etc.
In this context, the aim of this paper is to describe a mobile and wearable device oriented learning model that helps the students to comprehend the English Language better which is used in their lectures and study.

1. Literature review

As constant usage of smartphones becomes evident among students, various mobile learning applications have recently been developed. Many authors have seen the potential mobile devices promise in teaching. Concretely speaking, in a research [1], English language students have used 2D barcodes, namely Microsoft Tags, to learn new vocabulary more efficiently. Furthermore, in another paper [2], the potential of context-aware mobile language learning is presented, targeting German and Thai students.

Considering the many language learning apps widely available today across various platforms, an overview of some is presented in a rather interesting column (Godwin-Jones, R. (2011)), in which the author also explains the technologies used for developing such apps.
Language learning apps can seem effective in that they provide a personal and learner-centered learning opportunity with ubiquitously accessible and flexible resources and activities. This could encourage learners to develop a sense of individuality and develop life-long learning habits [4].
The Blended Learning approach to teaching a foreign language is taken into account by Sharma, P. and Barrett, B. In their book [5], they present technological tools which can be used in the classroom as well as instructions on how to use the Internet for teaching.
The effectiveness of smartphone usage has been tested in a different research where findings show that smartphone usage has a great impact on 99% of targeted students [6].
Smartphones are even being used for pronunciation learning. A rather efficient technique is presented in a paper by Lee et al. [7], where users can correct their pronunciation through listening to native pronunciations.
What was revealed in a study [8] is yet another point on the benefits of smartphone usage in the teaching process. Namely, the learner's positive learning mood.
Likewise, it has been concluded that through an app-based spelling learning, not only did students made progress in acquiring spelling ability, but developed learning habits as well.
To our observation, most of the current research, at least when it comes to vocabulary learning, is based on fixed set of words, while our model differs in the continuous expansion of the starting set of vocabulary words. That is, the initial number of words in the set of words grows proportionally to the new learning material of the respective subject. .

2. The model

One way of making the process of learning a foreign language much easier for students is by making the language itself easily accessible to them at any given time. We firmly believe students should be regularly exposed to new vocabulary and they should be motivated to practice communicating in English with their peers more often. After all, practice makes perfect.
Having in mind the excessive use of mobile phones and wearable devices among students, we recommend a way of discovering and learning new words through the use of the very same mobile devices. Thus putting the smartphones to good use.
The suggested model consists of three main parts. The first, and foremost, being the front - end part of the model i.e. the application used by the students. The second part is the back – end, or server – side, part consisted of the network infrastructure and the servers used for data storage. Finally, the third part is the teachers' part, which includes a desktop application in which the students' activity and progress is being supervised. Because of technical similarities, and for descriptive purposes, the first and the third part of the model will be grouped in the next section. We would like to emphasize that the students (and their teachers) are themselves a huge part of this model.
The briefly discussed building blocks of this language acquisition model will be separately described in greater detail in the following sections.

3. The front-end part

For us, one of the most important prerequisites for a language acquisition model is its usability and effectiveness. To achieve the set goals, we use a mobile application that serves as an interface between the students and the material they need to learn. The app is connected to multiple databases which will be discussed in the section dedicated to the description of the server - side part of this model.

The application used by the teachers is mainly designed to function as a simple, yet efficient, monitoring station. All data entered by the students is visible to the desktop app.
However, one may argue that for this kind of model it is of greater importance to more thoroughly describe the application that the students use. It itself, is constructed of multiple modules. Such module is the "Random word generator", where students get a different word every time they click a button, alongside a task to translate that word. If the translation is done correctly by the student, the student receives in-app points. But, if the student doesn't know the word he/she can save it to a personal "list of words" or simply ask a friend for help. In order to make the app more interesting, during this activity, groups of words are formed. An example of one of those groups is the "Most difficult words this week". The goal is to form a list of words that can be reviewed over and over by the students, so ultimately they can remember the new vocabulary more easily.
In order to use the smartphone application, the student first needs to sign in using his/her student id and password. Figure 1 shows the Student sign in page.

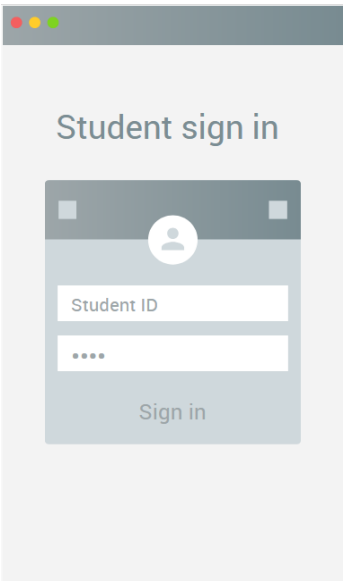

Fig. 1 Student sign in page, part of the mobile application that the students use.

Once the student has successfully signed in, he/she can practice and improve vocabulary skills through the use of the previously described "Random word generator" module. Figure 2 illustrates an example of the use of this module. Students get a new word with a click of a button. Afterwards, they have to fill in the correct translation and submit their answer.

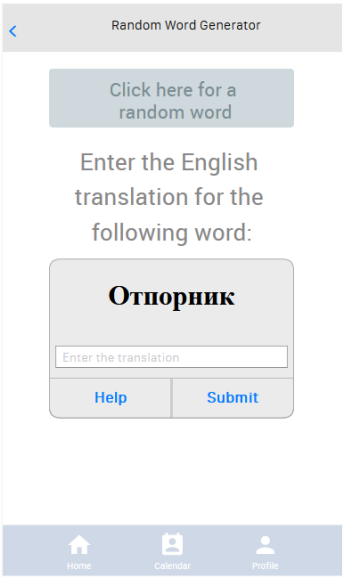

Fig. 2 Random word generator page, part of the mobile application that the students use.

The starting set of words is previously entered (hardcoded) into a database named "Word bank". In the "Word bank" there are many English words with their corresponding translation. An algorithm is used to check whether the translation is correct or not. As an extension to this module, even the Google Translate API may be used so that students could translate other words and strings instantly. The point of this module is to get students familiarized with as many English words as possible.

Through the application each student can add any word of their choice. That word will be sent to the "Words added by students" database. Afterwards, each student can enter a translation for any of the words stored in that database. Later, the translation is sent to the teacher for approval. For each correct translation the student receives in-app points. This way students are motivated to continuously update the starting vocabulary of the app. This part of the model puts an emphasis on encouraging students to learn more freely from each other.

Another very useful module of the application is the "Words used in this lecture" module. Here, the goal is to find words unknown to the app and possibly to the students. Particularly, words that have been used in the students' current lecture but have not been added to the "Word bank" nor the "Words added by students" database yet. The found words are then sent to the students via the app's notification system. Please note that an algorithm scans for words written in the students' native language. Despite being temporarily stored in a database, at that moment the words don't have a suitable translation (or any translation at all). The students' task for this part is to find and enter the English translation of each new word. Afterwards, the translation of the word is sent to the teacher. If the teacher approves the translation, the English translation is then instantly linked to the corresponding word. In the next step, the unknown word along with its translation is stored in the "Word bank" database. Finally, all students who have correctly done the translation receive in-app points for each correctly translated word.

The data flow between the presentation notes, the network and the databases is illustrated in Figure 3. Combined together, the previously described features of the app result in a real-time update of the current set of words whilst encouraging student activity. In other words, the beauty of this module is that the in-app vocabulary grows in proportion to the students' own vocabulary.

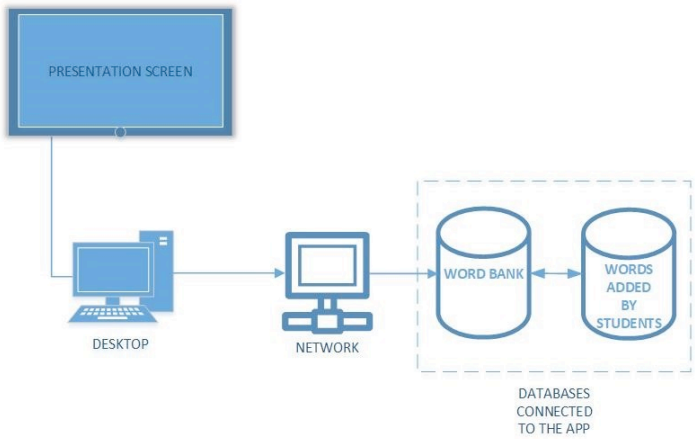

Fig. 3 Real-time vocabulary update.

The working principle behind this module is based on simply scanning the PDF/PPT file that the lecturer uses for presentation purposes. This module can be modified to scan for words either in English or any other spoken language (students' native language), meaning that it is reversible.

Figure 4 presents the algorithm used for scanning the lecture notes and adding words to the "Word bank" in real-time.

In the first step, the app connects to the databases and then loads the file from which potentially unknown words can be acquired. The actual scanning for new words begins after the file is loaded.

Until all the words have been looped, the algorithm executes a series of if-else statements. First, a check is performed to determine whether all words in the file have been scanned. If not, the algorithm proceeds onto scanning the next word. At this point, another check is performed to see whether the word has already been added to either of the databases.

If the algorithm discovers that a word has already been added to a database, it skips that word and returns to the point where it checks whether there are any other words remaining to be scanned.

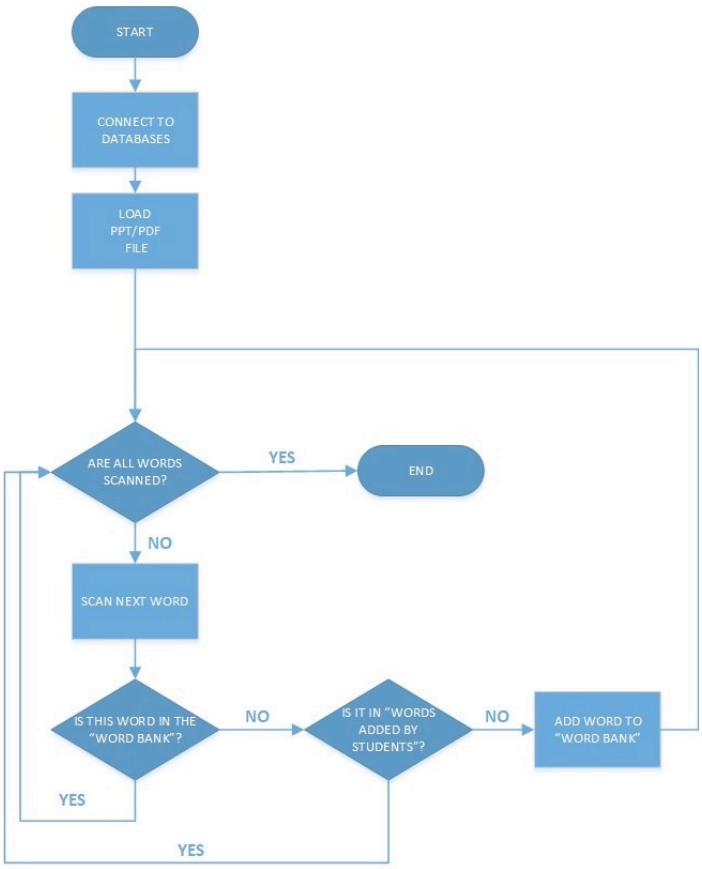

Fig. 4 The algorithm used for performing real-time scan for unknown words.

As a result of the wearable devices' popularity, this model features a smartwatch application, similar to the previously described smartphone application. Figure 5 shows a screenshot of the menu featured in the smartwatch application. Again, the student can select the "Random word generator" module which is based on the same module used in the smartphone app. What's interesting about the smartwatch app is that it uses a phonetic algorithm so that students can practice and work on their pronunciation. Speech-to-text technology is used to convert voice to text. If the student pronounces the given word correctly, he/she receives in-app points. Through the use of the "Practice saying the word" module, students receive tasks to pronounce the words from the "Word bank" which is regularly updated. This app uses the same databases and the same back-end technologies as the smartphone app uses.

Fig. 5 The smartwatch application.

The "Practice saying the word" module is shown in Figure 6. Through a click of a button, the student is given one random word. Next, the student has to hold the other button and repeat i.e.

correctly pronounce the same word. For the purposes of this application a microphone has to be used. In that manner, the student can use either the smartwatch's built-in microphone or use a microphone from a headset.

Fig. 6 The smartwatch app, "Practice saying the word" module.

4. The back-end part

For the purpose of this model, a fully functional network has been built. A simplified illustration of the network infrastructure that enables the communication between the students' mobile devices and the teacher's application is shown in Figure 7.

Even though only two databases have been introduced, the complexity of this model demands the use of other databases as well. To be more precise, one such database is used for storing the students' data (name, surname, year of study, etc.). Another database has to be used to store the teachers' data. Different databases for teachers and students are used because the entries in the teachers' database have rights to modify the content in other databases, while the entries in the students' database have limited, even read-only access to some databases, as was previously discussed.

As one might expect, all of the databases have to be stored somewhere on a server. We find that Amazon's cloud computing services, also known as Amazon Web Services (AWS) are ideal for such use. Indeed, AWS offers a variety of database storage plans. A few services, which are used in this English language acquisition model, will be briefly explained in the next few sentences.

For example, the Amazon EC2 service enables us to create and manage our own server on an operating system of our choice. Additionally, using the Amazon VPC service all data, which is stored in the databases, is kept secure and only available to those involved (students and teachers). Of course, privacy is important to both students and teachers.

The notification system used to notify students of newly added words that may be unknown to them is part of AWS as well. For this purpose, we use the Amazon SNS, a notification system which can be integrated with apps written in various programming languages, running on any platform (web, mobile, Android, iOS). This is particularly useful for the successful implementation of the model as it consists of applications that will run on smartphones and wearables which run on multiple operating systems.

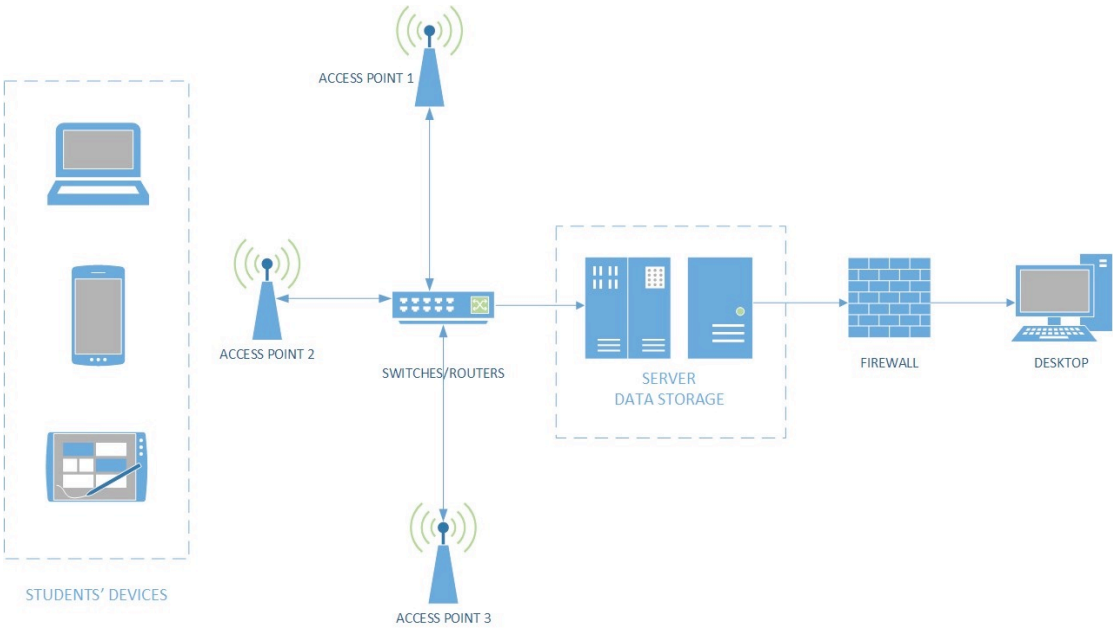

Fig. 7 The network infrastructure

As was previously stated, one feature of the application is grouping words by different categories. That is achieved by using Amazon's Data Analytics in the Cloud service. Moreover, among the vast range of tools offered by AWS, there are some that adequately meet the data gathering demands of the desktop application used by the teachers. To be more precise, data regarding the daily time spent in using the application by individual students as well as their current performance, progress of task completion etc.
Furthermore, different AWS networking products are used for the network infrastructure as well, making the network shown in Figure 7 only a small portion of the network used from Amazon's service – Network as a Service (NaaS).
Having all the data stored on the cloud will enable students to exploit this model's resources anywhere and anytime. Using their smartphones and smartwatches, through an already familiar user interface, students can learn new vocabulary and practice their pronunciation (or revise) at their own pace. This was actually one of the starting objectives of this model.
In our opinion, students should be exposed to the English Language vocabulary outside of the faculty if good results are expected in the process of language learning and acquisition.

Conclusions

This model can be further modified and molded to serve as a teaching aid not only at the universities, but also in high schools and elementary schools, especially vocational secondary schools where knowledge of English Language terms and vocabulary is much needed.
As in the findings of other studies, the students' satisfaction of using mobile technology while learning was, as expected, at higher levels. The presented model is tested from a technical point of view in a university environment and gives satisfactory technical characteristics to all of the modules which creates secure perspectives for using in schools and universities from teachers and students. At the same time, it's also a good blended learning tool.

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