



Qudra

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Dedication

We are glad to announce the project was done and we would like to thank many individuals who dedicated them selves to help finishing this :

- 1- Dr Samah Alajmani, who helped in guiding and supervening this project.
- 2- Faculty members : Dr. Hdar, Dr. Abdullah and Dr. Du'aa who helped in teaching and advising.
- 3-Mr. Sattam to help us in understanding the difficulties of hearing-impaired people in their lives.

Abstract

Abstract-

Physical disability has a big impact on daily life, for example, people with hearing impairment. This disability could cause difficulty to communicate with normal people. Also, it considers a big barrier to easily communicating with hearing impairment. In general, a lack of daily communication should not be a big barrier to socializing, job, education, or productivity. It is worth noting that, for the hearing-impaired it's hard for them to communicate with others. Also, for normal people is very difficult to learn sign language for communication. Therefore, Artificial intelligence (AI) technologies have the ability to significantly contribute to social integration by breaking down communication barriers between hearing-impaired people and the community. Recently, advancements in sensing technology and AI algorithms have committed to creating a variety of apps to help the hearing-impaired. There is a shortage of applications that can support them. The main goal of this project is that apply an Android for hearing impairments using deep learning to translate Saudi Arabian sign language into text, and also artificial intelligence to translate text into sign language for normal people. As well as, selecting a deep learning algorithm that is called CNN and applying it to a real ArASL dataset. Many tests were conducted for this algorithm on 5 and 8 layers, therefore, getting the same accuracy with the best result is 0.98 percent.

Keywords- Artificial intellegence (AI), Sign Language(SL), Deep Learning(DL), Hearing-impairment.

ملخص البحث (عربي)

الملخص-

الإعاقة الجسدية لها تأثير كبير على الحياة اليومية ، على سبيل المثال ، الأشخاص الذين يعانون من ضعف السمع. يمكن أن تسبب هذه الإعاقة صعوبة في التواصل مع الناس العاديين. كما أنه يعتبر عائقاً كبيراً أمام التواصل بسهولة مع ضعاف السمع. بشكل عام ، لا ينبغي أن يكون الافتقار إلى التواصل اليومي عائقاً كبيراً أمام التنشئة الاجتماعية أو العمل أو التعليم أو الإنتاجية. وتجدر الإشارة إلى أنه بالنسبة لضعف السمع ، يصعب عليهم التواصل مع الآخرين. أيضاً ، من الصعب جداً بالنسبة للأشخاص العاديين تعلم لغة الإشارة للتواصل. لذلك ، تتمتع تقنيات الذكاء الاصطناعي (AI) بالقدرة على المساهمة بشكل كبير في التكامل الاجتماعي من خلال كسر حواجز الاتصال بين الأشخاص ضعاف السمع والمجتمع. في الآونة الأخيرة ، التزمت التطورات في تكنولوجيا الاستشعار وخوارزميات الذكاء الاصطناعي بإنشاء مجموعة متنوعة من التطبيقات لمساعدة ضعاف السمع. هناك نقص في التطبيقات التي يمكن أن تدعمها. الهدف الرئيسي من هذا المشروع هو تطبيق Android لضعف السمع باستخدام التعلم العميق لترجمة لغة الإشارة السعودية إلى نص ، وكذلك الذكاء الاصطناعي لترجمة النص إلى لغة إشارة للأشخاص العاديين. بالإضافة إلى اختيار خوارزمية التعلم العميق التي تسمى CNN وتطبيقها على مجموعة بيانات ArASL حقيقية. تم إجراء العديد من الاختبارات لهذه الخوارزمية على طبقات 5 و 8 ، وبالتالي الحصول على نفس الدقة مع أفضل نتيجة هي 0.98 percent.

الكلمات المفتاحية- الذكاء الاصطناعي ، لغة الإشارة ، التعلم العميق، الإعاقة السمعية .

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1 Introduction

Nowadays, technology has become more spread in many areas. The most important of these technologies are artificial intelligence (AI). AI is the simulation of human intelligence processes by technology, particularly computer systems. Expert systems, natural language processing, speech recognition, and machine vision are examples of AI applications.

The hearing impairment is known as individual's inability to hear sounds adequately. Hearing is required for normal speech and language development. Hearing the speech of people in the family and surrounding environment helps a child learn to talk. Hearing impaired cases Speech impairment also it is affects ability to communicate using speech. People who are affected by this use other media of communication such as sign languages.

Sign language is a language in which communication is based on visual sign patterns to express one's feelings. Sign Language significantly facilitates communication in the deaf community. There is a communication gap when a deaf community wants to express their views, thought of speech and hearing with normal people.

Currently, almost all communities rely on human translators. Which human translator can be expensive and inconvenient and may not available all time . Thanks to the development in areas of deep learning and computer vision, researchers have developed various automatic sign language recognition methods that can interpret sign gestures in an understandable and fast way . This narrow downs the communication gap between impaired and normal people and makes deaf and mute people more independent. They do not need a human translators thanks to new technology by using it they can live their daily routine lives normally.

Each country that uses its own sign language is concerned about its own syntactic and grammatical meaning. Deaf and mute people communicate their thoughts and emotions through their respective sign languages. The language which is being used in Saudi Arabia

is called Saudi Sign Language (SSL).

The importance of our application lies in several aspects. We will state the obvious to us as researchers. For people with hearing impairment in terms of office jobs, Qudra makes it easier for them to deal with customers, as well as it makes it easier for customers to deal with employees with hearing disabilities. Also, in terms of daily life, it makes it easier for them to communicate with people and also helps them in the ability to rely on themselves anywhere without hesitation to communicate with others. In addition to this, from an educational point of view in communication with there friends and teachers easily, the text is translated into sign language, and sign language into text . Because deaf and mute people can't search on Google easily by voice and we recognise most the deaf-mute have issues with writing what they need so we add this feature they can use Qudra application to search about anything readily.

1.1 Overview and Problem Background

People with impairment relied entirely on their family or on human translators to meet all of their requirements. This case was before the advancement of technology and our growing reliance on it. It is worth mentioning that, after technological development, people with impairment can depend on themselves to meet their needs and perform their work and tasks using programs and websites that are tailored to meet their needs. On December 3 of each year, persons with impairment, including deaf-mute, are celebrated with the aim of promoting the rights of persons with an impairment in all aspects of life. In addition to this, the aim of educating people about the importance of the participation of persons with an impairment in the political, social, economic, and cultural fields. Persons with impairment should enjoy their full rights without feeling inferior in anything. So many applications have been applied that seek to help persons with impairment in different areas of life. The deaf-mute applications seek to help them through learning sign language or

translating speech into a sign. Additionally, the ability to communicate with deaf-mute because they need the application that supports them in their educational, communicative, and career lives, and the community needs to communicate with them. As estimated, the percentage of people with impairment in the Kingdom of Saudi Arabia is 7.1 percent, or (1,445,723 million) people out of the population of 32.94 million. The number of deaf mutes is 289,355. Hence, applications are very important for those people to accomplish their daily lives easily without the need to depend on others. This can lead us to work on Vision 2030. So, we decided to create an application to support them.

1.2 Problem Statement

Disability is a condition that makes it difficult or impossible to speak, walk, hear, and other senses. It will be either via birth or as a result of some unfortunate life events. About millions of people are deaf and mute around us. Hearing-impaired people and normal people have always found it difficult to communicate. Confidence and self-esteem will increase with effective communication. Sign language helps deaf-mute people to communicate with other people [2]. However, not everyone is conversant with sign language. Therefore, this app will make it easier for deaf-mute people to interact with hearing people. This application will help to translate text to sign language and capture the sign language from the live video or gallery for translate it in to text.

Although the world has become technologically, people with impairments still have challenges. The challenge for hearing-impaired people, who face many difficulties. Compared to people with perfect hearing, they see and move in the environment completely differently. Here are some of the problems they face daily, so you can better appreciate the challenges they may face. For the hearing-impaired, it's hard for them to communicate with others who don't know sign language. Also, for normal people is very difficult to learn sign language for communication.

1.3 Objectives

In this project, we aim to achieve the following objectives:

- Helping deaf-mute people to communicate with society.
- Helping the community to communicate with the deaf-mute.
- Helping the deaf-mute in practical and educational life.
- People with impairment do not need anyone to help them.
- Applying deep learning algorithm (CNN) to get the best accuracy result.

1.4 Scope

With many applications designed for people with hearing-impairment, a special Android application will be developed to help them so that they can engage with the community and practice their practical life easily and without the need for help from anyone, as the application will convert language saudi signal into text and convert text into language saudi signal.

1.5 Contributions/Significance of the Project

By the end of this project, we expect to obtain the following benefits:

- Facilitate office jobs.
- Facilitate daily life.
- Facilitating learning.
- Facilitate dealing with customers.
- Facilitate people's communication with them.
- Facilitate their communication with people.

1.6 Activity Plan

Figures 1.1 and 1.2 shows the detailed activity plan for our project in one academic year starting from analysis phase and ending with the testing and evaluation phase.

Week	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
<i>Choosing the ideas</i>	█												
<i>Collection of information</i>		█											
<i>Writing the Proposal preparation</i>			█	█	█	█							
<i>Learning needed skills</i>							█						
<i>System analysis</i>								█	█				
<i>System design</i>									█	█			
<i>Design prototype</i>										█			
<i>Finalize project reports chapters</i>											█		
<i>Preparing the project</i>												█	

Figure 1.1: Activity Plan For Semester 1

week	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
<i>Learning programming about mobile phone application</i>	█	█											
<i>Development application evolution</i>		█	█	█	█	█		█	█				
<i>Final report</i>							█	█					
<i>Finalize project reports chapters</i>								█	█				
<i>Design the posters</i>										█			
<i>Writing content</i>										█			
<i>Project presentation</i>										█			
<i>Preparing the presentation</i>											█		

Figure 1.2: Activity Plan For Semester 2

1.7 Summary of the Remaining Chapters

This report is consisting of five chapters: The first chapter deals with the introduction about our goals and need to create this app and the target group. The following chapter 2 will deal with Literature Review where there is so many app we are compared in details. Followed by third chapter which is System Analysis and Design, here was used water fall model, and we will show you the user interface prototypes of Qudra application, so we have some diagram in this chapter, Use Case Diagram and their Scenario, Class Diagram, ERD and Schema. Also followed by chapter 4 will deal with Implementation and Testing that include the Hardware and Software specifications, Interface Implementation, Dataset and Database, Testing and Some Program Code. The last chapter is chapter 5 will be the Conclusion, Recommendations and Future Works we will show the important references and the questionnaire which was help us to think in details of app specification.

1.8 Conclusion

This chapter provided general introduction to the project, Overview and Problem Background, Problem Statement, Objectives, Scope, Contributions/Significance of the Project, Activity Plan and Summary of the remaining chapters. In the next chapter included specific Introduction, Summary of Related Works, Comparison of Related Works and Conclusion.

2 Literature Review

2.1 Introduction

One of the most difficult problems facing the field of deep learning is the recognition of hand gestures. The Sign Language Recognition (SLR) system succeeded in recognizing fixed or moving hand gestures. A research article was published in 1991 on the possibility of recognizing sign language using a neural network for the first time by researchers Murakami and Taguchi. With the development in the field of computer vision, colored gloves were invented to help the disabled community, but they failed because the glove only translates individual letters and works only with American Sign Language, and many researchers have come up with other ways in the technical field that support this category [5]. Many applications have been created that help to recognize and learn sign language :

2.2 Related Works

١.٢.٢ لغة الاشارة

Sign language application created by Dubai government for the importance of serving people with hearing Impairment. This app aims to familiarize the person with sign language by teaching him/her some of the most frequently used terms.

How to use: The person can select something that he wants from a list and then enters the training program. Thus, many terms will appear to him, and he can select one of them. Finally, the term will be explained in sign language .Figure 2.1 illustrates this application.



Figure 2.1: The Interface of The Application **لغة الاشارة**.

٤.٢.٢ الترجمان

The translator is an application for translating text or audio into Arabic sign language through virtual characters. When typing a text or recording a voice, the virtual character begins to speak. Figure 2.2 shows this application.



Figure 2.2: The Interface of The الترجمان Application.

٤.٢.٢ مكتبة لغة الإشارة السعودية

An application that helps sign language trainers for the deaf-mute by teaching sign language in video clips. How to use: by searching for a term and then the search results appear. The person clicks on the result, then a video appears that explains the term in sign language. Figure 2.3 demonstrates this app.

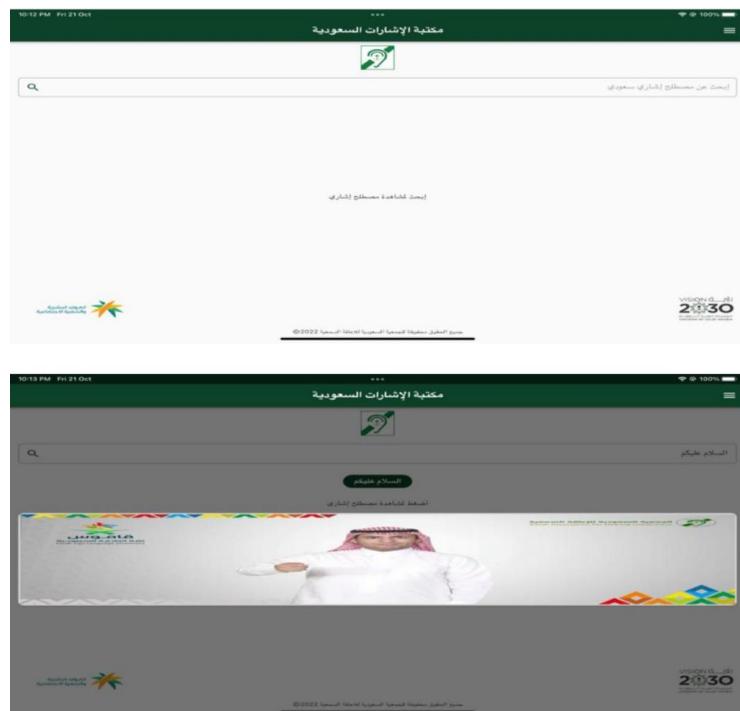


Figure 2.3: The Interface of The **مكتبة لغة الإشارة السعودية** Application.

2.2.4 BrightSign

The only glove in the entire world that can quickly translate any sign Into any language spoken. Figure 2.4 shows this application.



Figure 2.4: The Interface of The BrightSign Application.

2.2.5 Mimix

An app for sign language translation. Its 3D friendly avatar that can comprehend both spoken and written English is used to deliver real-time sign language translations. A sign language dictionary is part of the Mimix software ,the 3D avatar will enable you to easily communicate with deaf-mute people without the need for sign language knowledge. Mimix 3D's goal is to improve accessibility for daily communication with the deaf and hard of hearing, not to replace human sign language interpreters in that capacity. Mimix has a more of features, including real-time translation of speech and text from English to sign language. Figure 2.5 demonstrates this app.



Figure 2.5: The Interface of The Mimix Application.

2.2.6 Hand talk

An application that converts text and voice into SL through a 3D of a character. Figure 2.6 demonstrates this app.



Figure 2.6: The Interface of The Hand Talk Application.

2.2.7 LetMeTalk

People with hearing impairments can use LetMeTalk app to create their own sentences to speak to others. This app will help them with their communication issues. The fact that this program is available in 16 different languages is the most significant factor. You can make your own dictionary of terms you frequently use. Figure 2.7 shows this application.

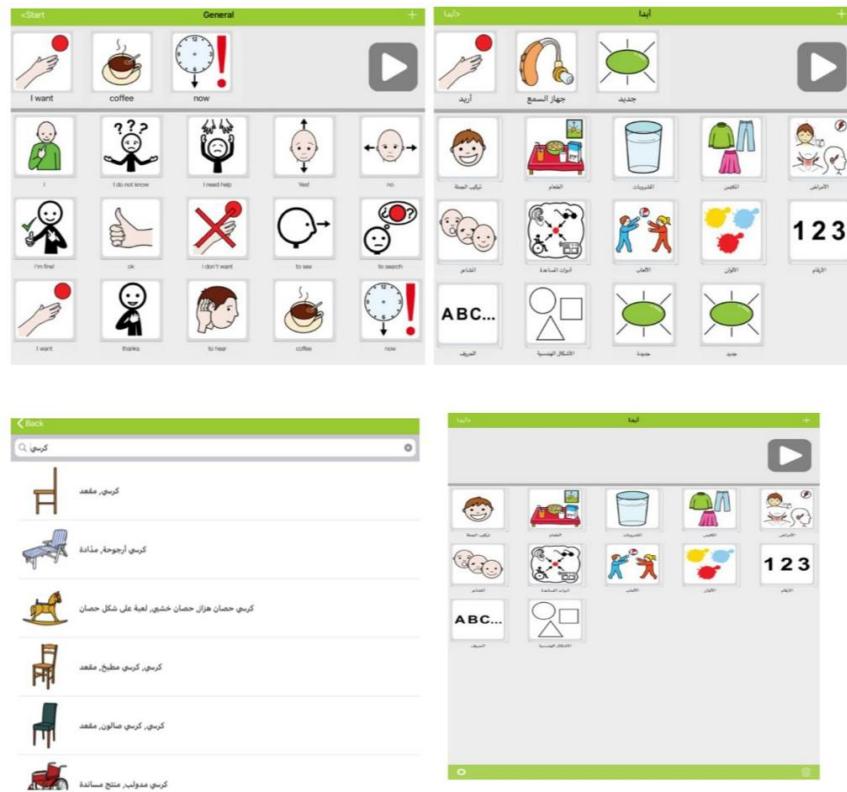


Figure 2.7: The Interface of The LetMeTalk Application.

2.2.8 I Hear You

This application translates sign language into voice or text, as well as translates text or voice into sign language through the use of virtual characters. Figure 2.8 shows this application.

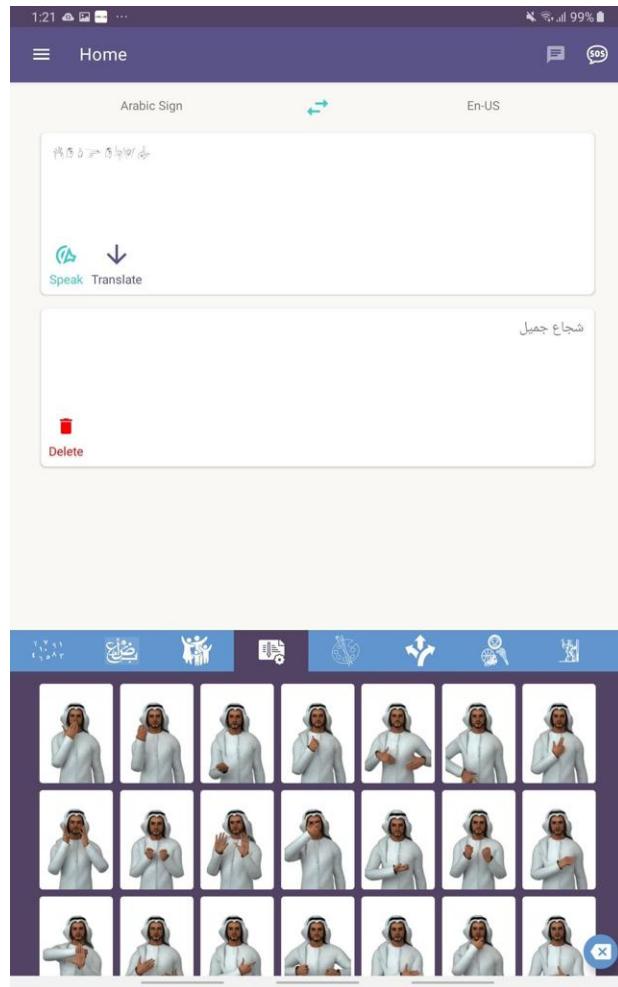


Figure 2.8: The Interface of The I Hear You Application.

2.2.9 TalkiTalk

An app that facilitates communication between hearing-impaired people, deaf mute, and people who have hard of hearing (HOH). The software translates speech to text in a number of different languages and transforms text to speech. Figure 2.9 illustrates this application.

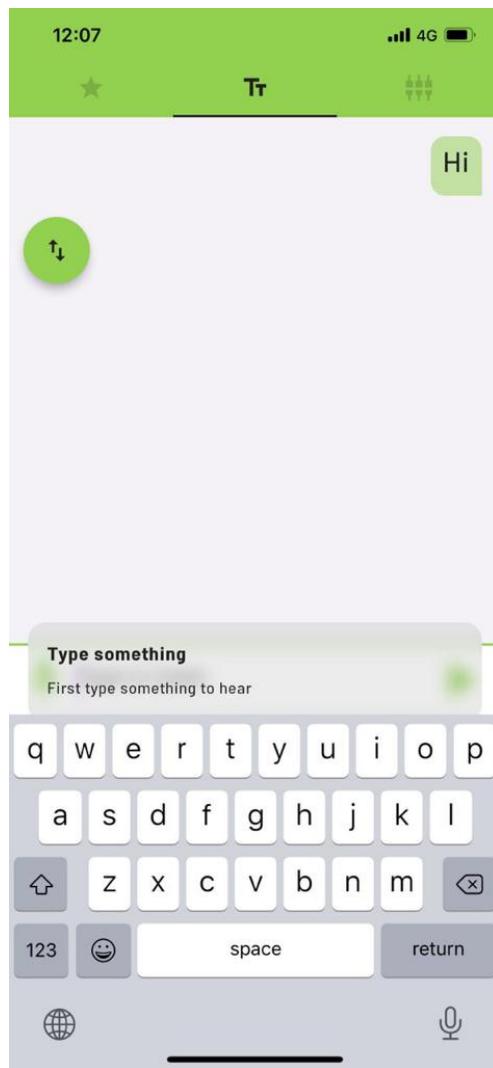


Figure 2.9: The Interface of The TalkiTalk Application.

2.2.10 RogerVoice

An app that allows hearing-impaired people to make phone calls using speech recognition and written captions. A user-friendly interface was developed by Roger Voice. Figure 2.10 illustrates this application.

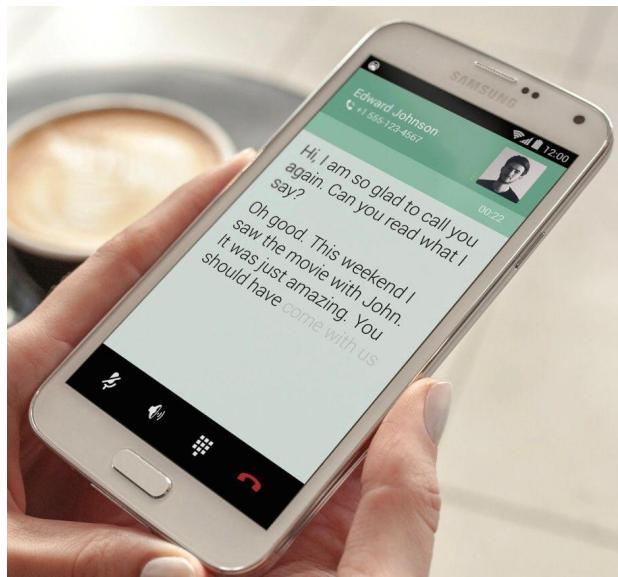


Figure 2.10: The Interface of The RogerVoice Application.

2.2.11 DeafChat

An app uses modern Artificial Intelligence (AI) technology to convert speech to text in real time, and reverse written text to speech. Figure 2.11 illustrates this application.



Figure 2.11: The Interface of The DeafChat Application.

2.2.12 SpeakLiz

SpeakLiz uses Artificial Intelligence (AI) to analyze audio, recognize human voices, and more in real time. It is designed for use in 35 different languages. 4 features set SpeakLiz apart:-

- Sound Environment: The app can pick up the sounds around you and alert you to them, including doorbells, animals, emergency sounds, and more.
- Voice to Text: Internet is required to convert spoken language to text.
- Text to Voice: Generate voice from text (including emoji), compatible with Bluetooth speakers.
- Sign Language: The SpeakLiz sensor allows you to convert sign language to voice and text in real time (limited American Sign Language available).Figure 2.12 shows this application.



Figure 2.12: The Interface of The SpeakLiz Application.

2.2.13 Deaf-Mute communication helper

This application is designed especially for people with hearing and speech difficulties. With this app you will not have communication problems ever! Simple way to communicate for people with hearing and speech difficulties using speech recognising and converting to text or synthesize conversational speech from the typed text. Figure 2.13 illustrates this application.



Figure 2.13: The Interface of The Deaf-Mute Communication Helper Application.

2.3 Summary of Related Works

In order to make the suggested system more distinctive and efficient, it is crucial to compare it to other systems. To know if the application help hearing-impaired people, or no. so we created a table that have a summary of related works.

Figure 2.14 , 2.15, 2.16 Shows A table comparing the advantage and disadvantage of the applications who related to our application.

Applications:	Advantages:	Disadvantages:
 لغة الاشارة	1- Teaching the basics of sign language.	1-It does not contain a way to communicate with sign language teachers in the application. 2-Few words. 3-Does not contain complete sentences that facilitate communication.
 الترجمان	1-Supports Arabic language. 2-Supports hearing impairment. 3-Translate text or audio into sign language. 4-Dictionary includes 6000 words and Free download.	1-Doesn't support Saudi Arabian sign language. 2-Hard to use. 3-Doesn't contain contact support team.
 مكتبة الإشارات السعودية	1-Includes general terms.	1-Lack of direct communication with teachers. 2-Does not provide a complete sentence. 3-Does not include all general terms.
 Mimix	1-Sign Language Dictionary. 2-Learn Sign Language. 3-Free application. 4-the translate is done word by word.	1-It's not support Saudi Sign language. 2-It is not easy to use. 3- Doesn't pick up the words easily.

Figure 2.14: Advantage and Disadvantage Table

Applications:	Advantages:	Disadvantages:
 brightSign	<ul style="list-style-type: none"> 1-There are over 100 commonly used sign languages in the world, and thousands more personal variations. they support any sign language - even your own one! 2-With over 450 voice choices, as well as options for different speeds and tone you can make BrightSign sound exactly as you want; whether male, female, young or old. 	1-Expensive.
 Hand talk	<ul style="list-style-type: none"> 1- Converts the voice into sign language. 2- Converts the text into a sound. 3- Support American Sign Language. 4-Support Brazil sign language. 	<ul style="list-style-type: none"> 1- It does not support Saudi Sign Language . 2- It does not convert sign language into sound or text.
 LetMeTalk	<ul style="list-style-type: none"> 1- Has 16 languages. 2- Free application. 3- Available on App Store and Google play. 4-sentence with described pictures. 5- the word is categorised on category. 	<ul style="list-style-type: none"> 1- Not easy to use. 2- The words is limited. 3- You can't write sentences, only choose.
 I Hear You	<ul style="list-style-type: none"> 1-Access the map through the app. 2-Translate YouTube clips. 3- Free application. 4-Supports two sign languages (Emirati ,American). 	<ul style="list-style-type: none"> 1- Doesn't support Saudi Arabian sign language. 2-Doesn't include images recognition.

Figure 2.15: Advantage and Disadvantage Table

Applications:	Advantages:	Disadvantages:
 TalkiTalk	1-Easy to use. 2-Supports many languages.	1-Reads text only. 2-Does not support the Arabic language. 3- The voice recording feature is not free.
 RogerVoice	1- So easy to get started. 2- There are features included within the app, such as an option to enlarge the size of the displayed text and another to mute the microphone. 3- Users can easily retrieve individual transcriptions of conversations by selecting the appropriate name under the list of contacts. 4- Supports several languages.	1-Doesn't support Arabic language. 2-Currently not available in Saudi Arabia region.
 DeafChat	1-Easy to use. 2-This can be useful for people who are deaf- muted and attending talks, conferences, lectures. 3-Currently supporting 8 different languages.	1-Doesn't support the Arabic language.
 SpeakLiz	1-Available on App store Google play. 2-Apple Watch turns into a real-time audio detector. 3-working in 35 languages. 4-Has support team.	1- Price: Free, with In App Purchases.
 Deaf-Mute Communication Helper	1-Speech to Text recognizing in 34 languages. 2-Text To Speech synthesis in 27 languages. 3-Easy to use.	1-Not free .

Figure 2.16: Advantage and Disadvantage Table

2.4 Comparison of Related Works

Figure 2.17 shows the comparison of related works to improve the features of our application. We come to the conclusion that while the current study is comparable to other systems, the purpose of our system differs, thus the proposed system will be an Android application that will make it simpler for those with hearing impairment.

Application	Support Saudi Arabian Sign language	Support America Sign language	Simple to use	Contains contact support team	Support IOS	Support Android	Good interface	Support the community	Support the Deaf-Mute	Free	Image recognition	Google Search
لغة الاشارة	NO	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	NO
الترجمان	NO	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	NO
briehrtSign	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO
Mimix	NO	YES	NO	NO	YES	YES	NO	YES	YES	YES	NO	NO
مكتبة الإشارات السعودية	YES	NO	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO
Hand talk	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO
LetMeTalk	NO	NO	NO	YES	YES	NO	YES	YES	YES	YES	NO	NO
IHearYou	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO
TalkiTalk	NO	NO	YES	YES	YES	NO	YES	YES	YES	YES	NO	NO
RogerVoice	NO	NO	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO
DeafChat	NO	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO
SpeakLiz	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	NO
Deaf-Mute communication helper	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO
Qudra	YES	NO	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES

Figure 2.17: The Comparison of Related Works.

2.5 Conclusion

In this chapter, we mentioned several applications that are like our application. Thus, we noted that our system is similar to the previously mentioned Apps. Where all these applications were created specifically for people with hearing-impaired. The main objective is to assist the deaf-mute in their daily lives. After comparison and investigation, we found that our application is very different from other applications in terms help deaf-mute people by converting sign language to text, converting the text to sign language.

3 System Analysis and Design

3.1 Introduction

Systems analysis and design, is to comprehend what humans require in order to process or transform data, store data, and output information within the framework of a specific organization or industry. Analysts aim to find and address the appropriate problems by doing detailed study[7]. In this chapter, we will discuss the methodology used in our system, including its advantages and disadvantages, and then we will go over the stages of the methodology in the proposed system, including an explanation of each level. Then we will discuss the proposed system's functional and non-functional requirements, detailing the functional requirements for both the (admin, deaf-mute, user) users. The functional requirements will be represented within the use case diagram, where the most important functions of the(admin,deaf-mute, user) will be described in the form of cases. The use cases will be described in tables that show the main scenario for each use case as well as the actors in responsible for them. This chapter will also include system diagrams that will be designed and displayed. Such as the Class Diagram, ER Diagram. The relational database schema will be configured within this chapter as the entities will be mapped to tables. The prototype will include the application interfaces.

3.2 Methodology

An approach to the Software Development Life Cycle (SDLC) that specifies the order of steps to be taken while building software projects is known as a software development methodology or a software development process model. There are numerous approaches for developing software, and they vary from one another in terms of time to release, quality, and risk management. Regardless of the technique used, all life cycle models incorporate the fundamental life cycle processes, but maybe in a different order[6].

3.2.1 Waterfall Model

The Waterfall Model is the most established and widely used SDLC model. This model's distinct feature is its sequential steps. It progresses from requirements analysis to design, coding, testing, and maintenance. Furthermore, it ensures that there are no design flaws prior to the development of a product[1]. The waterfall process is briefly explained in the steps that follow.

Phases of Waterfall Model:

- Phase 1: Gather requirements:**

It is to provide a description of a system's behavior. Typically, it is data supplied by clients. As a result, it creates the terms of the agreement between the clients and the software developers. Simply put, requirements are gathered, examined, and then the necessary documentation is created to aid in the development process.

- Phase 2: System and software design:**

The previous phase's information is evaluated, and a proper implementation plan is developed. It is the planning and problem-solving phase of developing a software solution. It covers algorithm design, software architecture design, database conceptual schema design, logical diagram design, and data structure definition.

- Phase 3: Implementation:**

All requirements will be converted to the production environment.

- **Phase 4: Integration and system testing:**

Focuses on the thorough testing and inspection of software solutions that have been created to satisfy the initial requirements. Additionally, it is during this stage that bugs and system flaws are discovered, addressed, and improved.

- **Phase 5: Deployment:**

After going through testing, the application is now prepared for deployment after being thoroughly validated and verified. The final consumer must confirm that the product truly satisfies their demands and that the original specs were accurate.

- **Phase 6: Operation and maintenance:**

The software may require alterations, enhancements, error fixes, and refinements after it has already been released. Therefore, this phase is the procedure for handling such issues.

Advantage of Waterfall Model:

- Simple to comprehend and use.
- Widely recognized and used.
- Since it's a linear model, implementation is relatively straightforward.
- Works effectively with established products and gives new teams structure.
- Minimizes the cost of planning.
- Each phase is processed and finished separately.

Disadvantage:

- Inflexible: All criteria must be known up advance.
- A delivery that isn't documented that is only created in the last stage.
- The client could not be clear about their needs and wants.

Figures 3.1

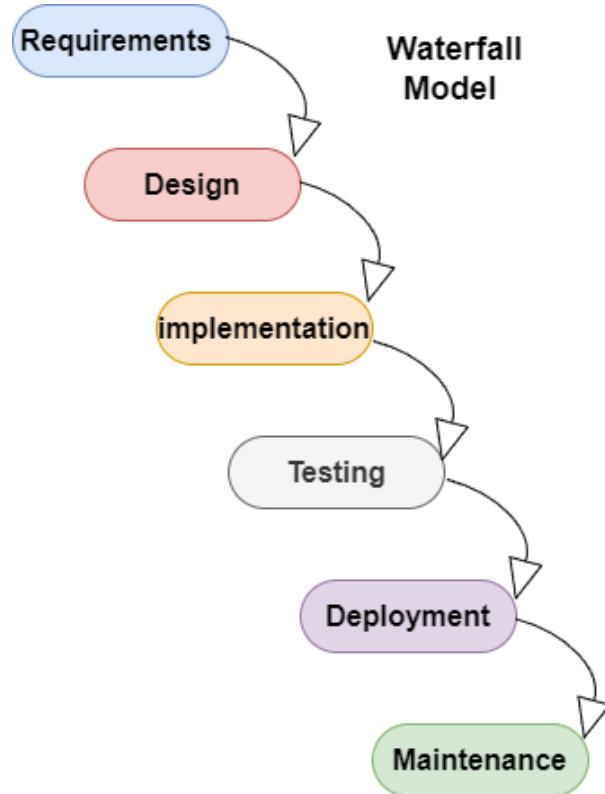


Figure 3.1: The Waterfall Model.

Our Project phases:

- **Phase 1: Gather requirements:**

To gather information about the needs of those with hearing impairment, a questionnaire will be employed. We'll use Google Forms to construct a survey, which we'll then share on social media. We will incorporate the findings in the report after gathering the data through the questionnaire.

- **Phase 2: System and software design:**

Where it will be discussed how to address the needs of (deaf-mute ,user) users by UML digrams (Use case and Class diagram) and recommend the essential tools to get the best outcome. Figma will be used as a tool to construct the application prototype .

- **Phase 3: Implementation:**

The suggested method will be put into practice by developing an Android application using visual studio code, a platform for writing programs that makes it simple for programmers to write the source code of Android applications using Python.

Python is a programming language that enables the development of full apps that can run on the devices of deaf-mute users.

- **Phase 4: Integration and system testing:**

After each phase of the implementation process has been integrated and tested individually, the entire system will be examined for potential defects or errors.

- **Phase 5: Deployment:**

The suggested application will be put through both functional and non-functional testing before being made available to users or released onto the market. We will invite people to download the program into their mobile devices and give it a try in order to collect feedback. Once the application has undergone testing and been found to be in good working order, it will be made ready for use by deaf-mute users.

- **Phase 6: Operation and maintenance:**

The working environment may have some challenges after clients use the program, thus it will be crucial to carry out the required maintenance.

Figures 3.2

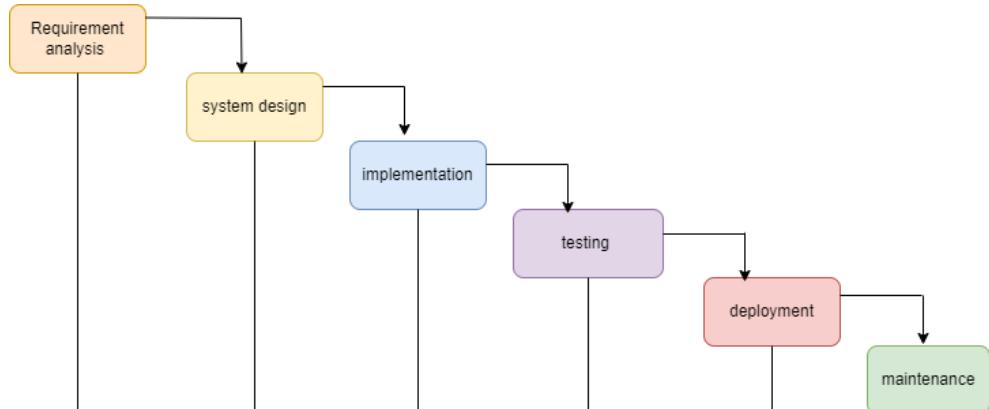


Figure 3.2: Maintenance Phase.

3.3 Requirements Analysis and Definition

The limitations that a system must work and be designed under are the requirements, together with what the customer expects from the system. There are two types of requirements: nonfunctional requirements and functional requirements.

3.3.1 Functional Requirements:

Functional Requirements Functional specifications define how the system should behave. The actions that the system must take to behave in this way can be described as services, tasks, or functions [10].

- **User Functional Requirements:**

1. The user is able to register for the first time.
2. The user is able to log in to use the application.
3. Select the user icon to register and log in.
4. Transform text to annotation movement hand: when normal person write text and wants to convert it into Saudi sign language by using deep learning.
5. User can control the setting of the application as color and language.
6. The user can log out.

- **Deaf Mute Functional Requirements:**

1. Deaf-mute is able to register for the first time.
2. Deaf-mute is able to log in to use the application.
3. Select the deaf-mute icon to register and log in.
4. Deaf-mute can transform his movement hand into text by using AI.
5. Deaf-mute can control the setting of the application as color and language.
6. Deaf-mute can search on google with his movement hand, and show the results of the search in google.

7. Deaf-mute can log out.

- **Admin Functional Requirements:**

1. Admin can log in to open the app.
2. Admin can log out.
3. Admin is able to manage the accounts of users: -When the user cannot log in as a result of a password, username error, or any registration difficulty. -The admin has Access to any user data and modifies or delete the data.
4. Admin able to maintain, for example: add features, and improve the app.
5. Admin Manage registration: -The Manage registration authenticates the passwords.

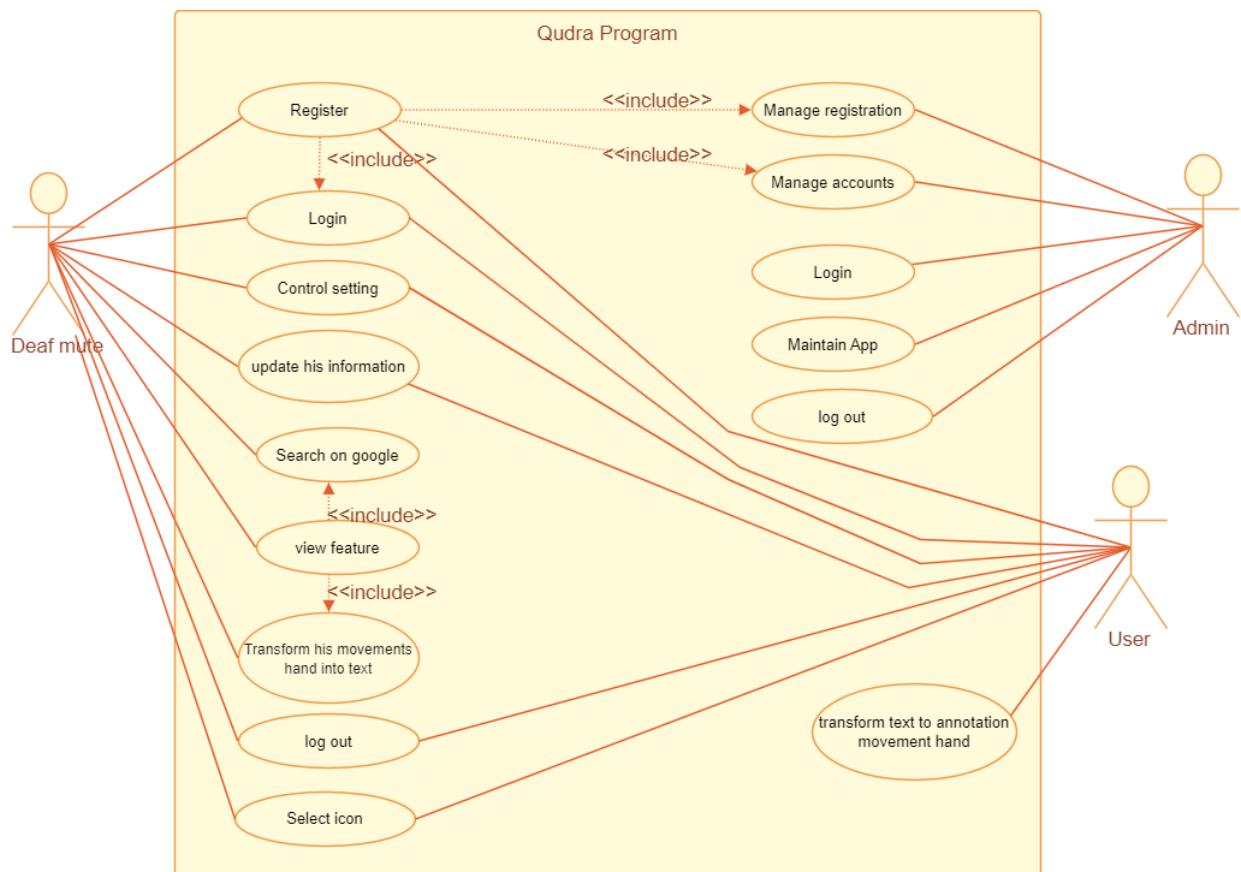


Figure 3.3: Use Case Diagram

The functional requirements can be summarized by a use case diagram in Figure 3.3.

3.3.2 Non-Functional Requirements:

Non-Functional Requirements A methodical and practical strategy to incorporating quality into software systems is presented in Non-Functional Requirements in Software Engineering. Systems must display characteristics of high-quality software, such as precision, speed, security, and adaptability. Even though there are numerous ways to satisfy functional needs in order to deliver required functionality, such nonfunctional requirements (NFRs) are challenging to solve in many projects [4]. Non-Functional Requirements for our system are:

- Usability: Users who are deaf-mute, user can perform the various operations with ease and clarity due to the system interface's clarity and simplicity.
- Availability: accessible to everyone at all times.
- Reliability: People who are deaf-mute, user must have access to a reliable system. Users who are deaf- mute and user provided private and secure information in the application.
- Responding time : The response time shouldn't be more than 10 seconds.
- Flexibility : The system must be adaptable and able to expand and improve its offerings if it is to be flexible.
- Performance: The system must operate with great precision and speed in order to deliver excellent services and outcomes.
- Supportability: Support addressing system changes as they happen and offering users help when they run into issues.
- Capacity : The system must support the Android operating system and simultaneously handle multiple concurrent user requests in parallel.

3.3.3 Domain Requirements:

Domain Requirements expectations pertaining to a specific software kind, use, or industrial vertical.

1-The most important domain requirements is to use this application you must have an android smart phone.

3.4 System Design

3.4.1 Prototype of the Application

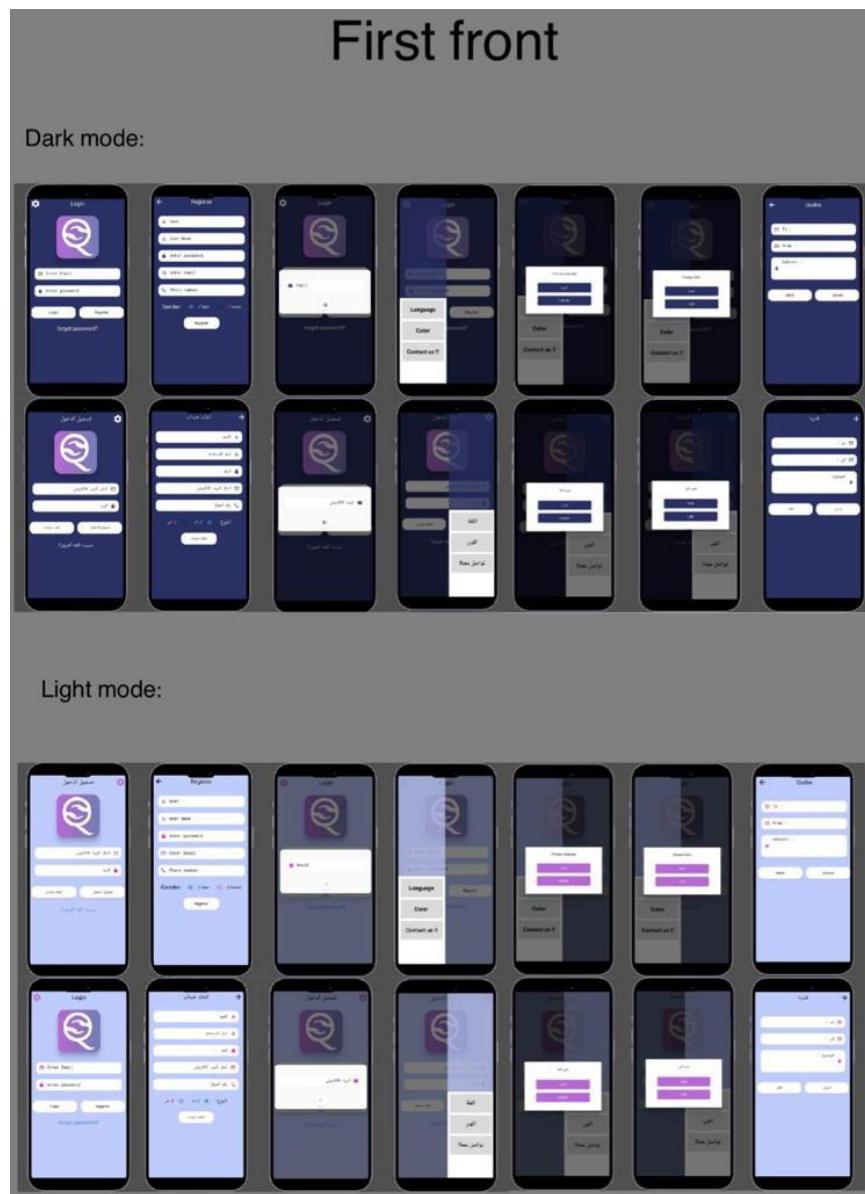


Figure 3.4: Prototypes

Second front

Dark mode:



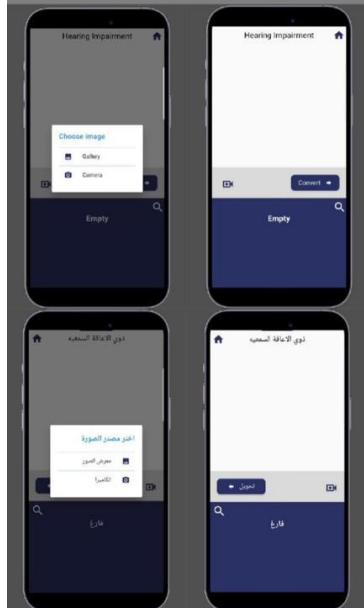
Light mode:



Figure 3.5: Prototypes

Hearing impairments:

Dark mode:



Light mode:



Figure 3.6: Prototypes

User:

Dark mode:



Light mode:



Figure 3.7: Prototypes

3.4.2 Description of the main scenarios

Manage application can be: Register, Login , Control setting, Update his information, Search on Google, Transform his movements hand into text, View feature, Manage registration, Manage accounts, Maintain app, Select icon, Sign in, Login, Log out, Transform text to annotation movement hand. The main scenario of each use case will be described in the following:

Table 3.1: Use Case 1: Register.

Use Case 1: Register	
Abstract	Person can register to be able to use the application's features.
Actor	Deaf-mute, User .
Pre-conditions	Has application.
Post-conditions	The account has been created.
Main scenario	[Begin] 1. Install the application. 2. Enter his information to create an account. [End]

Table 3.2: Use Case 2: Login

Use Case 2: Login	
Abstract	Person can log in to be able to use the application's features.
Actor	Deaf-mute, User
Pre-conditions	Make register.
Post-conditions	Use application's features.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Enter his username and password. 2. If the data is valid, the user enters the app. <p>[End]</p>

Table 3.3: Use Case 3: Control setting

Use Case 3: Control setting	
Abstract	Person can control the setting of the application as change the color.
Actor	Deaf-mute, User.
Pre-conditions	Login successful.
Post-conditions	Application setting changes.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Log in with his information. 2. Enter to applictaion's setting and change. <p>[End]</p>

Table 3.4: Use Case 4: Update his information

Use Case : Update his information	
Abstract	Person is able to update and change profile's information.
Actor	Deaf-mute,User.
Pre-conditions	Login successful
Post-conditions	Profile is updated
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Log in with his information. 2. Enter to application's setting and change. <p>[End]</p>

Table 3.5: Use Case 5: Search on Google

Use Case : Search on Google	
Abstract	Person is able to search on google with movement hands.
Actor	Deaf-mute.
Pre-conditions	Login successful.
Post-conditions	The results show in google
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Log in with his information. 2. To search with Google, click on the icon. 3. Automatically open camera. 4. The user moves his or her hands for three seconds. 5. Show the results in google. <p>[End]</p>

Table 3.6: Use Case 6: Transform his movements hand into text

Use Case : Transform his movements hand into text	
Abstract	Person is able to transform movements of his hand.
Actor	Deaf-mute.
Pre-conditions	Login successful.
Post-conditions	Application display text for movements.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Log in with his information. 2. Select the "transform" icon. 3. The camera will automatically open. 4. The deaf-mute makes his own movements. 5. Application display text. <p>[End]</p>

Table 3.7: Use Case 7:View feature

Use Case : View feature	
Abstract	Person view features of application.
Actor	Deaf-mute.
Pre-conditions	Login successful.
Post-conditions	The main features of the app are searching on Google and transforming movement with the hands.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Log in with his information. 2. The application displays the main page. 3. On Google, the user can select a search engine. 4. The user can manually select the transforming movement. <p>[End]</p>

Table 3.8: Use Case 8: Manage registration

Use Case : Manage registration	
Abstract	The passwords and face ID are validated by the administrator.
Actor	Admin.
Pre-conditions	Login successfully with username and password of admin.
Post-conditions	Update the user's information and validate it.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Login is successful. 2. Access information about users. 3. Validate the user's information. <p>[End]</p>

Table 3.9: Use Case 9: Manage accounts

Use Case : Manage accounts	
Abstract	Admin has Access to any user data and modify or delete the data.
Actor	Admin.
Pre-conditions	Login successfully with username and password of admin.
Post-conditions	Modify the user's information..
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Login is successful. 2. Access information about users. 3. Modify the user's information. <p>[End]</p>

Table 3.10: Use Case 10: Maintain app

Use Case : Maintain app	
Abstract	Admins should add features, and improve the app.
Actor	Admin.
Pre-conditions	Login successfully with username and password of admin.
Post-conditions	The application can be modified by the administrator.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Login successfully. 2. Modify the application by adding or improving features. <p>[End]</p>

Table 3.11: Use Case 11: Select icon.

Use Case : Select icon.	
Abstract	A person is able to select the user or deaf-mute icon.
Actor	User, Mute-deaf
Pre-conditions	Person has application.
Post-conditions	Person can log in or register type successfully.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Install the app. 2. App display icons on the screen. <p>[End]</p>

Table 3.12: Use Case 12: Login.

Use Case : Login.	
Abstract	Admin can log in to be able to use the application's features.
Actor	Admin.
Pre-conditions	Have admin's information.
Post-conditions	Use application's features.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Enter his username and password. 2. If the data is valid, the admin enters the app. <p>[End]</p>

Table 3.13: Use Case 13:Log out.

Use Case : Log out.	
Abstract	person is able to log out of the application.
Actor	Admin, User, Deaf-mute.
Pre-conditions	Person has to login.
Post-conditions	Person logout.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Select the logout option. 2. The user's account logs out of the application. <p>[End]</p>

Table 3.14: Use Case 14: Transform text to annotation movement hand.

Use Case : Transform text to annotation movement hand	
Abstract	Person can transform text to movements hand.
Actor	User.
Pre-conditions	Person has logged in.
Post-conditions	Input text to converted into hand movement.
Main scenario	<p>[Begin]</p> <ol style="list-style-type: none"> 1. Login by username and password. 2. Select feature transform. 3. Enter text. 4. App display photos as a result of machine learning. <p>[End]</p>

3.4.3 System Class Diagram

A class in UML is described as a group of objects with similar characteristics in terms of their structure, behavior, and relationships. A class is a rectangle with a name, some attributes, and some operations written inside it [8]. Figure 3.8 Shows class diagram .

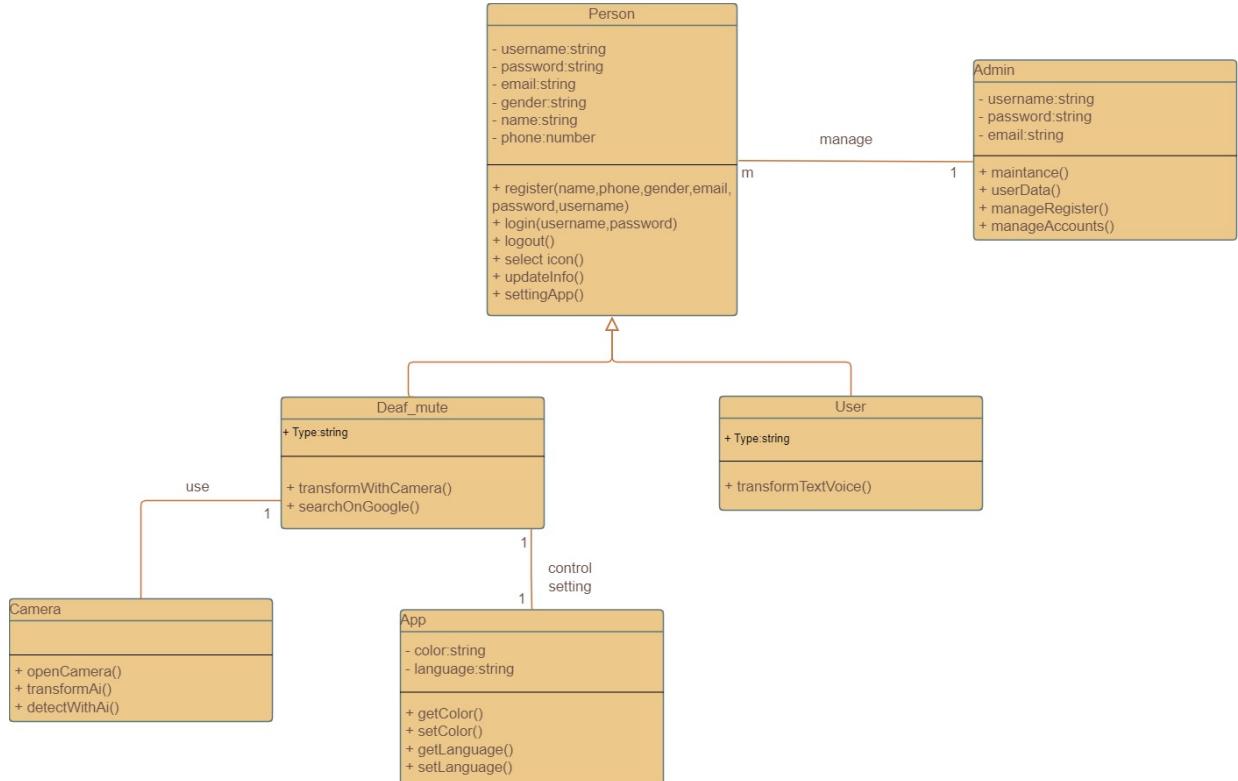


Figure 3.8: The System Class Diagram.

3.5 Database Design

3.5.1 ERD (Entity Relationship Diagram)

The entity-relationship (ER) diagrammatic approach is a visual representation of entity types, relationship different types, and attributes. One of the reasons often cited is that the ER diagram is easy to understand not only for systems analysts and database designers, but also for managers and users [3]. Figure 3.9 Shows class diagram .

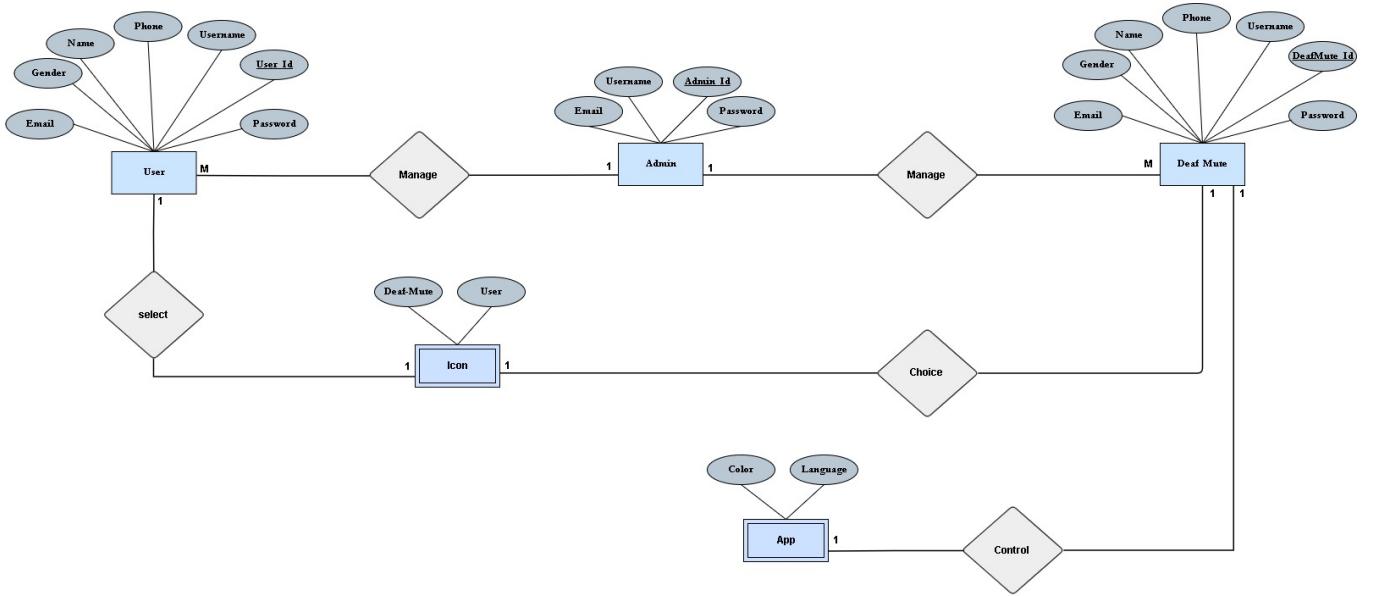


Figure 3.9: ERD System.

3.5.2 Relational Database Schema

The relational database schema can be obtained by mapping a class diagram to relational database using the following basic rules:

Rule 1: Mapping of class (or entity in Entity Relationship Diagram(ERD))

- For each class, create a table that includes all the simple attributes of the class.
- Choose an attribute as a primary key for the table.

Rule 2: Mapping of binary 0:1 association

- Mapping of binary 0:1 association (0..1 — 1..1).
- For each binary 0:1 association between two classes, include a foreign key which is the primary key from the cardinality (1..1) side.
- Mapping of binary 1:1 association (1..1 — 1..1). Merge the tables.

Rule 3: Mapping of binary 1:N association

- For each regular binary 1:N association, identify the N-side of the association.
- Include the primary key of 1-side table as a foreign key into the N-side table.

Rule 4: Mapping of binary M:N association

- For each binary M:N association, create a new table.
- The primary key of this table is composed of two foreign keys of the tables related to the two associated classes.
- In ERD, if the association has attributes, includes all the simple attributes in the new tables.

Rule 5: Mapping of class association (just for class diagram)

- For each class association, create a table T that includes all the simple attributes of the class association.
- The primary key of this table is composed of the foreign keys of the tables related to the associated classes.

Figures3.10 Shows Database schema .

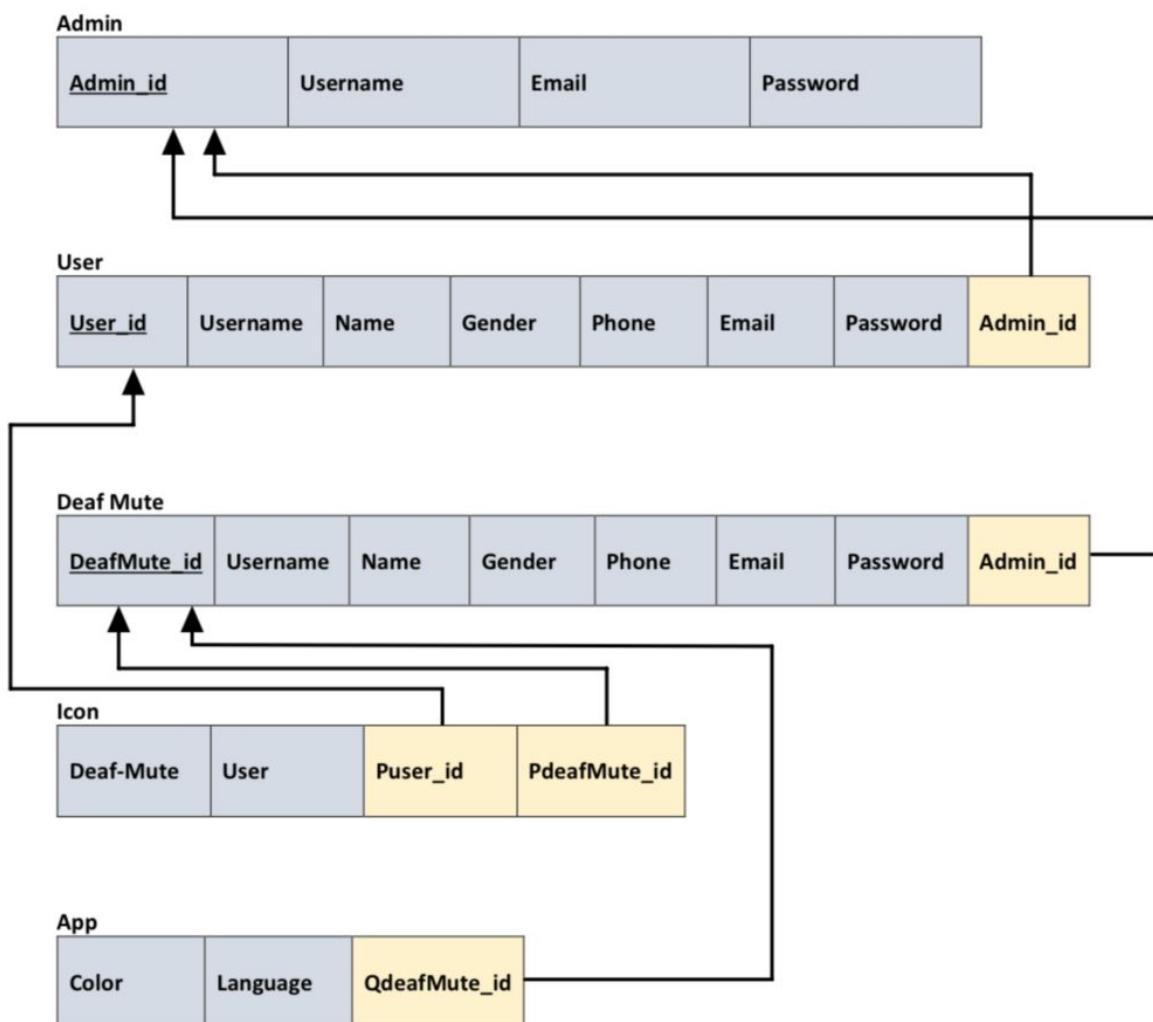


Figure 3.10: Database Schema.

3.6 Conclusion

In this chapter, We designed a prototype for the select icon (deaf-mute and user) system interfaces. We also made system diagrams, including use case diagram, class diagrams and ERD. The schema represents the relationship between these tables.

4 Implementation and Testing

4.1 Introduction

In this chapter, we will state the Hardware and Software that we have already used in our project. As well as, we will clarify the Saudi Dign Language Dataset that it has already worked on it. We will explain the Deep Learning algorithm which we also used to evaluate good accuracy. In terms of Programming the language, we used Python for the Backend, Flutter for the Frontend, and we use Firebase for the Database

Firstly, we have already selected Python in order to be easily readable and concise codes. Since Deep Learning and Artificial Intelligence involve complex algorithms so we used Python because of its simplicity to learn. This will lead to easy understanding and the creation of Deep Learning models. We used many libraries as following (certifi, cffi, charset-normalizer, cryptography, Deprecated, firebase, gcloud, googleapis-common-protos, httplib2, idna, jwcrypto, oauth2client, protobuf, pyasn1, pyasn1-modules, pycparser, pycryptodome, pyparsing, pythonjwt, requests, requests-toolbe, rsa, six, sseclient, urllib3, wrapt, keyboard, opencv-python, keras, scikit-learn, pandas, pyrebase4, ar-corrector).

Secondly, it is worth noting that we used Flutter because that is a platform for building mobile applications developed by Google. This platform has the ability to develop cross-platform, web, desktop, and mobile apps for iOS and Android devices. Also, we used Dart which has already been included in Flutter as a reactive programming language. This language is very important because it has the ability to accelerate and simplify development compared with conventional approaches.

Finally, we used Firebase which is a platform for app development that has the ability to create and expand popular apps and games. This platform is supported by Google and relied upon by millions of companies worldwide.

4.2 Hardware and Software Specifications

4.2.1 Hardware Specifications

Item	Description
Laptop	For installing needed programs
Mobile device	For testing the application
Internet connection	For downloading the needed programs

Figure 4.1: The Hardware Specifications

4.2.2 Software Specifications

Software's	Description
 Draw.io	diagrams.net (formerly draw.io) is free online diagram software. For using a flowchart maker, and network diagram software, to create UML online, as an ER diagram tool
 Microsoft word	Microsoft Word is a word processing software developed by Microsoft. Word is one of the leading applications for processing, creating, sharing, and editing Word documents on Windows PCs
 LaTeX	Overleaf is a cloud-based collaborative LaTeX editor used for scientific document writing, editing, and publishing. It includes tools for creating technical and scientific documentation. Overleaf is a collaborative writing and publishing tool for LaTeX and Rich Text that speeds up and simplifies the process of writing, editing, and publishing scientific documents
 smartdraw	Smartdraw is a web-based diagramming tool that includes quick-start templates for over 70 different diagram types. To create diagrams like org charts, ERD, and class diagrams
 Android Studio	The approved Integrated Development Environment (IDE) for Android application development
 Google Questionnaire	Google questionnaire is an online tool with many design options that allows users to create their own forms, surveys, and quizzes as well as collaboratively edit and share the forms with others to see their opinions and answers about a specific subject
 Figma	Figma is a web-based primarily based vector graphics app, editor, and click tool, with other features enabled by desktop applications for macOS and Microsoft Windows. Figma interfaces with powerful editing, design, and user experience capabilities
 PyCharm	PyCharm is a dedicated Python integrated development environment (IDE) that provides Python developers with a wide range of essential tools that are tightly integrated to create a cost-effective environment for productive Python, web, and data science development
 ANACONDA	An effort to streamline package management and deployment, Anaconda is a distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc)
 Firebase	Google Firebase is a Google-powered application development software that allows developers to create iOS, Android, and web applications
 Colab	Colab is ideal for machine learning, data analysis, and education because it allows anyone to write and execute arbitrary Python code through the browser
 Blender	Blender is a free and open source 3D creation suite. It supports the entire 3D pipeline—modeling, rigging, animation, simulation, and rendering etc
 Google Meet	Google meet: An application from Google services that is used for remote meetings, free and available to everyone, that allows sharing files and videos

Figure 4.2: The Software Specifications.

4.3 Interface Implementation

We have many Interfaces as following:

4.3.1 Login Interface:

If you already have an account, you can log in with email and password. Figure 4.3 shows login interface.

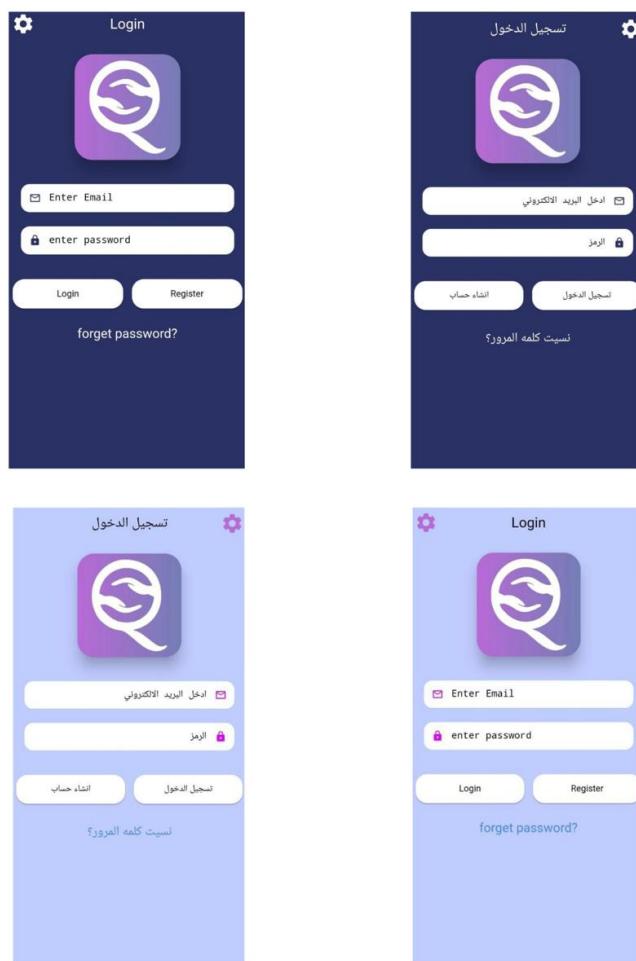


Figure 4.3: The Login Interface.

4.3.2 Register Interface:

User can register if she/he don't have account before. Figure 4.4 demonstrates register interface.

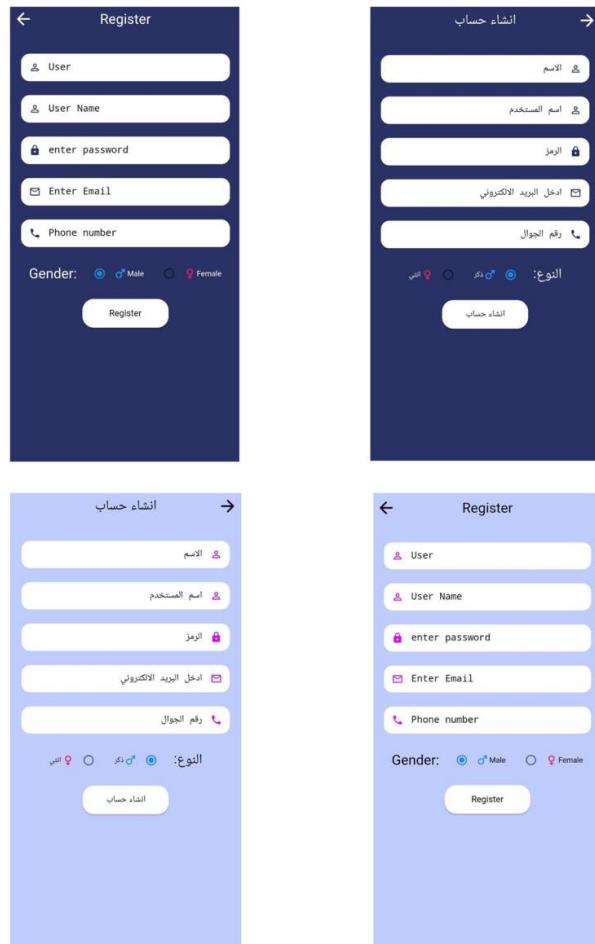


Figure 4.4: The Register Interface.

4.3.3 Settings Interface:

User can change language or appearance, also if she/he have a problem can contact a maintenance team. Figure 4.5 illustrates settings interface.

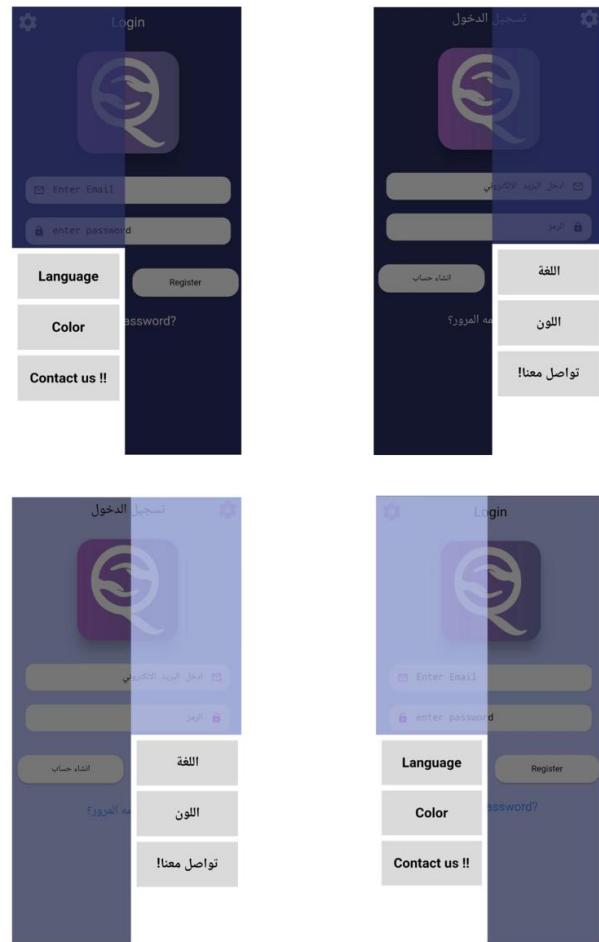


Figure 4.5: The Settings Interface.

4.3.4 Language Interface:

User can change a language either English Language or Arabic Language. Figure 4.6 shows language interface.

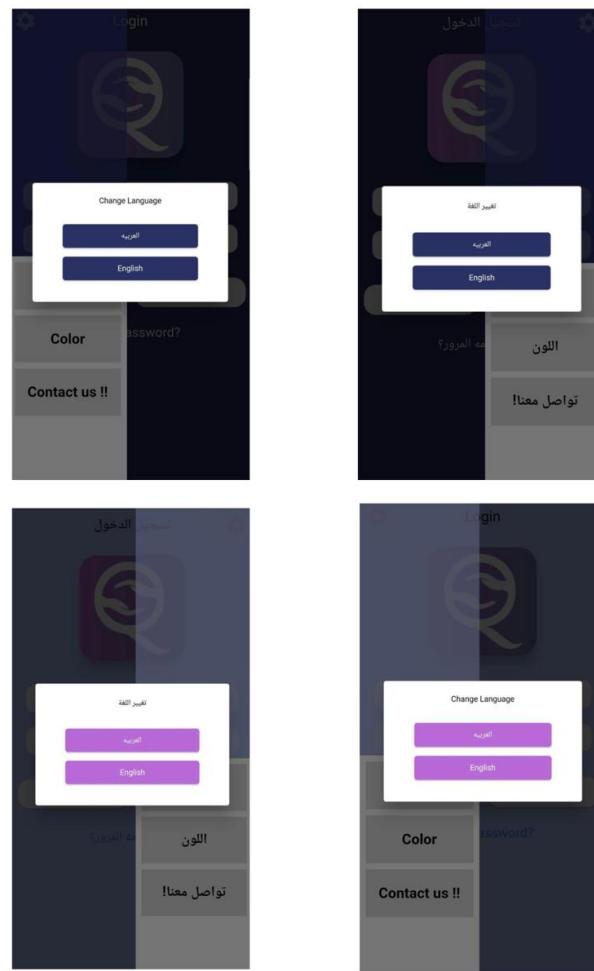


Figure 4.6: The Language Interface.

4.3.5 Color Interface:

User can change a appearance screen to either dark color or light color. Figure 4.7 demonstrates color interface.

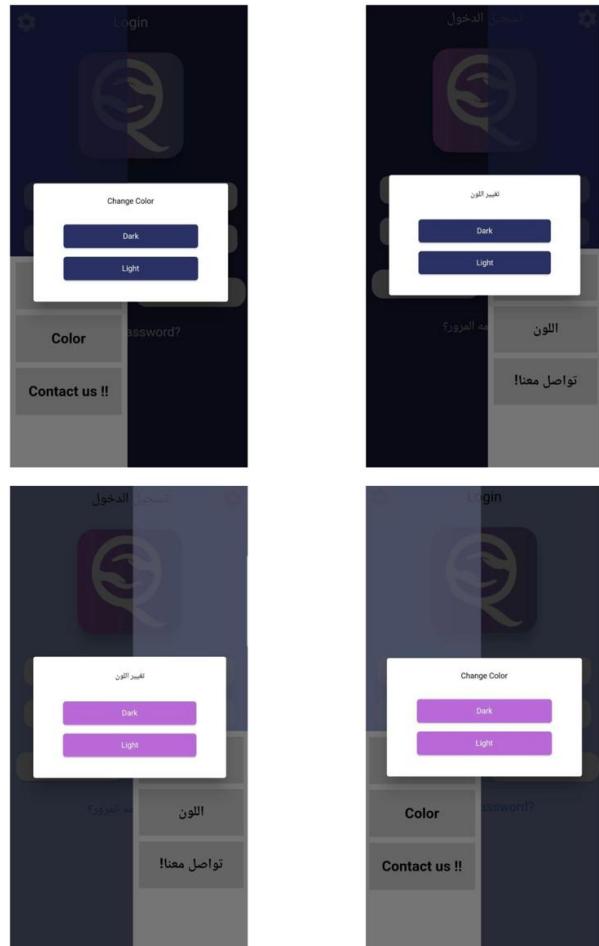


Figure 4.7: The Color Interface.

4.3.6 Contact Us Interface :

If you have any queries don't hesitate to contact us. Figure 4.8 illustrates Contact us interface.

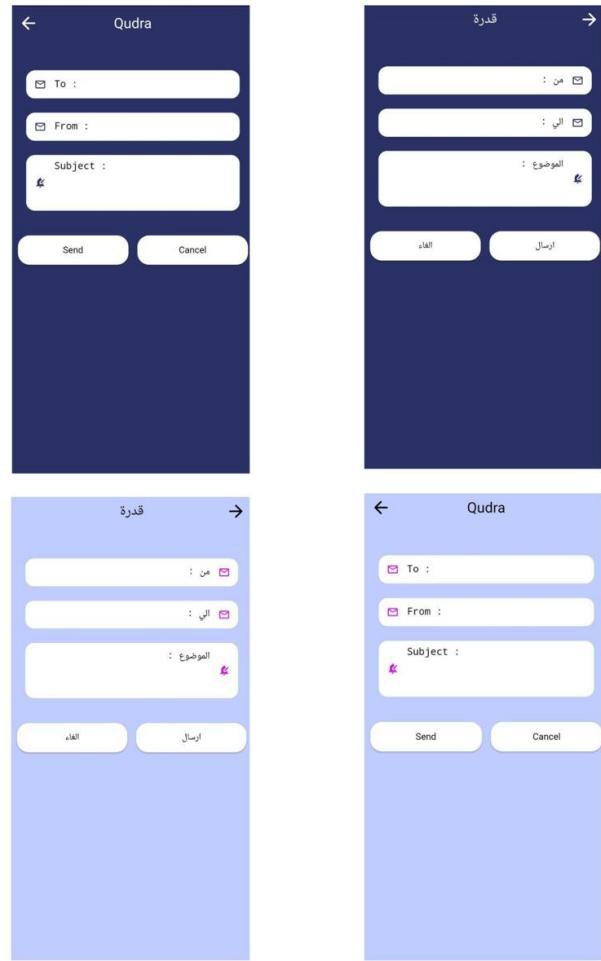


Figure 4.8: The Contact Us Interface.

4.3.7 Forget Password Interface:

If the user forget the password they able to reset the password. Figure 4.9 shows forget password interface.

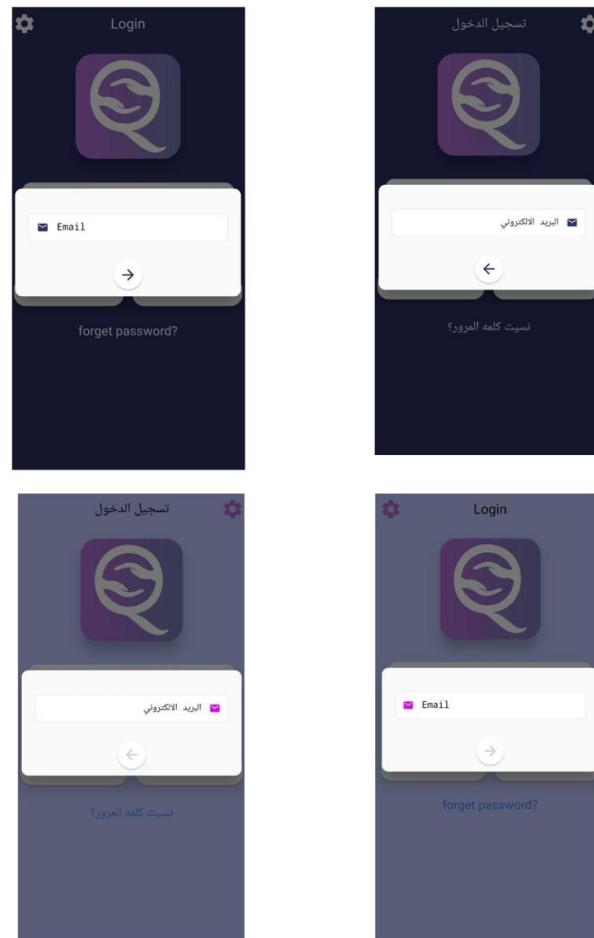


Figure 4.9: The Forget Password Interface.

4.3.8 Home Interface:

Consists of two options as following : 1-Hearing impairment. 2-User. Figure 4.10 demonstrates home interface.

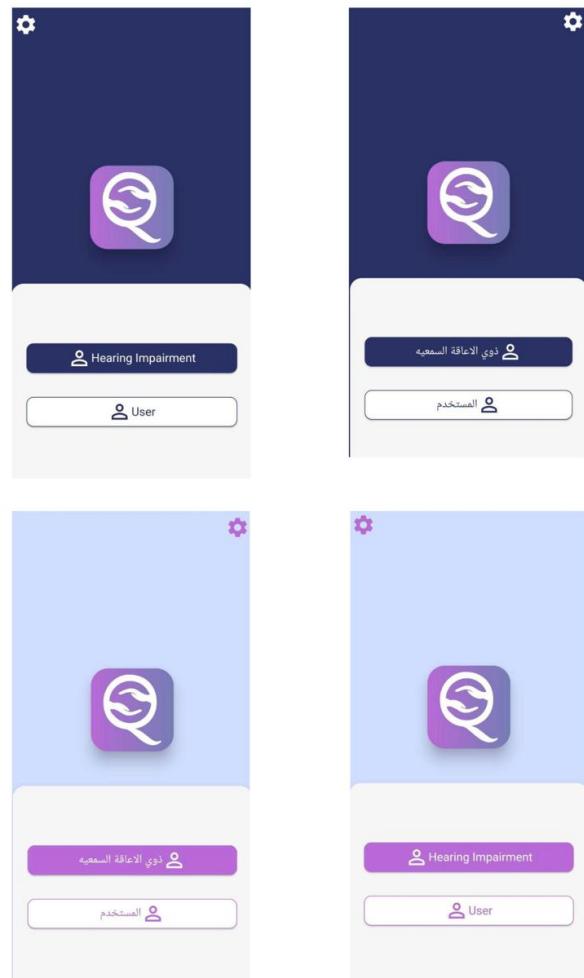


Figure 4.10: The Home Interface.

4.3.9 Sign-Out Interface:

If the user finished the application, he/she can sign out of the application. Figure 4.11 illustrates Sign-Out interface.

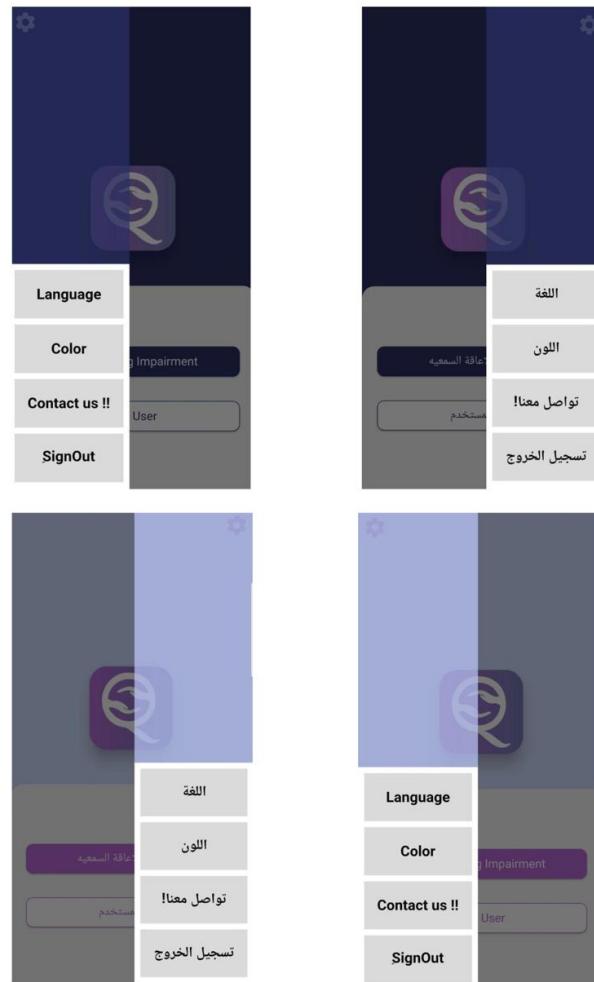


Figure 4.11: The Sign-Out Interface.

4.3.10 Hearing Impairment Interface:

The hearing impaired can convert the sign language into number and alphabet. Figure 4.12 shows hearing impairment interface.

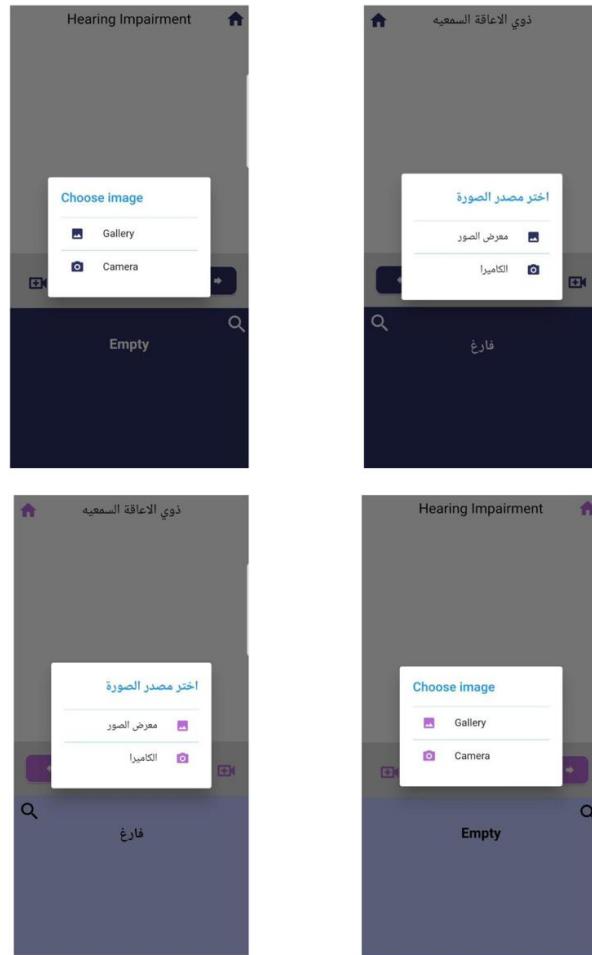


Figure 4.12: The Hearing Impairment Interface.

4.3.11 User Interface:

The user can convert some word into avatar. Figure 4.13 demonstrates user interface.

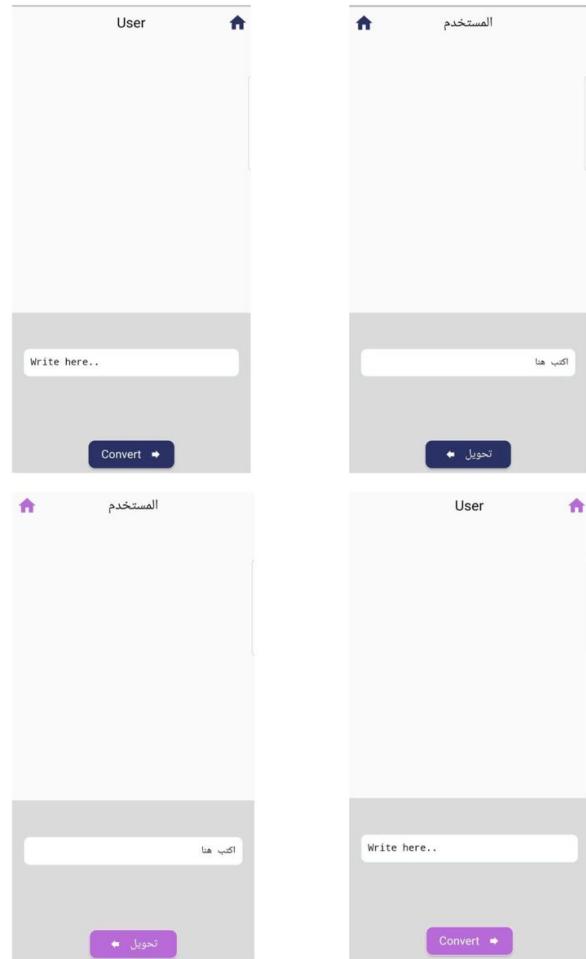


Figure 4.13: The User Interface.

4.4 Dataset and Database:

4.4.1 Dataset:

Datasets are essential in order to the approaches performance with respect to translation, recognition of sign language, and synthesis, this can lead to a lot of focusing on accurately capturing signs and meticulously annotating them[11]. Prince Mohammad Bin Fahd University in Al Khobar, Saudi Arabia, has produced a new comprehensive fully annotated dataset of Arabic Sign Language images called ArSL2018. In order to be available to researchers working in the fields of machine learning and deep learning [9]. This dataset consists of more than 54,000 images for the 32 Arabic sign language signs and alphabets. Also, we added a numeric dataset from 1 to 10. It is worth noting that, before building the model we should do Preprocess for the dataset. Preprocessing within any deep learning is associated with the transformation of data from one form to another. Usually, preprocessing is conducted to ensure the data utilized is within an appropriate format. After that, we needed to split the dataset into a training dataset and a testing dataset. We used (80 percent) of the dataset for the training model and (20 percent) of the dataset for the testing model. We used the training dataset to train the neural network directly. In the testing dataset phase, we evaluated the performance of our network after the completion of the training phase. We evaluated our performance using the essential confusion matrix in deep learning: the f1-score, accuracy, precision, recall and support.

4.4.2 Algorithm:

A convolutional neural network (CNN) algorithm is a network architecture for deep learning that learns directly from data. CNN is particularly useful for finding patterns in images to recognize objects, classes, and categories. In our project, we used AlexNet which considers the name of CNN architecture model, and utilized keras.models.Sequential. A Sequential model is appropriate for a plain stack of layers where each layer has exactly one

input tensor and one output tensor.

In the model implementation, we will implement the AlexNet CNN which is shown that the deep convolutional neural network can be used for solving image classification. We utilized 10-Fold Cross-Validation. It is primarily used in applied deep learning to estimate the skill of a deep learning model on unseen data. The general procedure is as follows:

1. Shuffle the dataset randomly.
2. Splitting the dataset into k groups to get different accuracy results.
3. Select the best accuracy.

- 5 layer result:

Layers	Parameters	Activation function
Conv2D Maxpooling BN	Filter 96/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 256/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 384/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 384/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 256/Kernel 3x3 2x2	ReLU
Flatten	-	-
Dense Dropout	4096 0.4	ReLU
Dense Dropout	4096 0.4	ReLU
Dense	32	softmax

Figure 4.14: The Network Structure Detailed Parameters For 5 Layer.

	precision	recall	f1-score	support
0	1.00	1.00	1.00	320
1	0.94	0.96	0.95	318
2	0.96	0.98	0.97	313
3	0.96	0.99	0.98	272
4	0.99	0.99	0.99	299
5	0.99	0.99	0.99	305
6	0.98	0.98	0.98	299
7	1.00	0.97	0.99	297
8	1.00	1.00	1.00	282
9	0.98	1.00	0.99	258
10	0.97	1.00	0.99	434
11	0.99	0.97	0.98	267
12	0.98	0.99	0.98	327
13	0.97	0.94	0.95	356
14	0.97	0.97	0.97	301
15	0.86	0.98	0.92	344
16	0.97	1.00	0.98	333
17	0.99	0.95	0.97	379
18	0.97	0.97	0.97	314
19	1.00	0.99	0.99	412
20	0.97	0.96	0.96	317
21	0.99	0.98	0.98	332
22	0.98	0.99	0.98	306
23	0.99	0.99	0.99	349
24	0.99	0.97	0.98	340
25	1.00	0.99	0.99	351
26	0.99	0.99	0.99	391
27	1.00	0.97	0.99	360
28	0.99	0.99	0.99	345
29	1.00	0.94	0.97	327
30	0.98	0.97	0.97	387
31	0.99	0.99	0.99	336
32	1.00	0.97	0.98	293
33	0.96	0.93	0.95	341
34	0.99	0.95	0.97	355
35	0.97	0.98	0.98	373
36	0.89	1.00	0.94	317
37	1.00	0.99	0.99	371
38	0.98	0.98	0.98	307
39	1.00	0.99	0.99	361
40	1.00	1.00	1.00	261
41	0.98	0.94	0.96	260
accuracy			0.98	13810
macro avg		0.98	0.98	13810
weighted avg		0.98	0.98	13810

Figure 4.15: The Result of 5 Layer.

- 8 layer result:

Layers	Parameters	Activation function
Conv2D Maxpooling BN	Filter 96/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 96/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 256/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 256/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 384/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 384/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 256/Kernel 3x3 2x2	ReLU
Conv2D Maxpooling	Filter 256/Kernel 3x3 2x2	ReLU
Flatten	-	-
Dense Dropout	4096 0.4	ReLU
Dense Dropout Dense	4096 0.4 32	ReLU softmax

Figure 4.16: The Network Structure Detailed Parameters For 8 Layer.

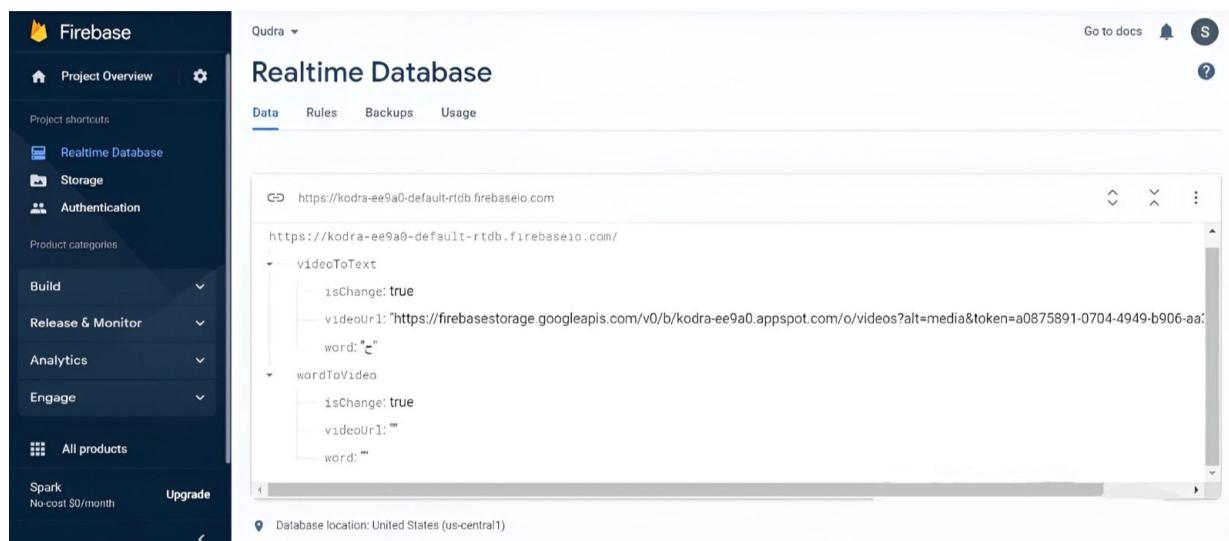
	precision	recall	f1-score	support
0	1.00	0.98	0.99	320
1	0.99	0.93	0.96	318
2	0.95	0.97	0.96	313
3	0.96	0.99	0.97	272
4	0.98	0.97	0.98	299
5	0.99	0.99	0.99	305
6	0.98	0.99	0.98	299
7	0.99	0.98	0.98	297
8	0.99	0.99	0.99	282
9	0.98	1.00	0.99	258
10	1.00	0.99	0.99	434
11	0.99	0.97	0.98	267
12	0.97	0.99	0.98	327
13	0.95	0.98	0.97	356
14	1.00	0.92	0.96	301
15	0.96	0.95	0.95	344
16	1.00	0.97	0.98	333
17	0.97	0.96	0.97	379
18	0.93	0.99	0.96	314
19	0.99	0.99	0.99	412
20	0.94	0.97	0.96	317
21	1.00	0.97	0.99	332
22	0.98	0.98	0.98	306
23	0.98	0.99	0.99	349
24	0.96	0.99	0.97	340
25	0.99	0.99	0.99	351
26	1.00	0.98	0.99	391
27	0.99	0.98	0.98	360
28	1.00	0.98	0.99	345
29	0.96	0.98	0.97	327
30	0.98	0.96	0.97	387
31	1.00	0.98	0.99	336
32	0.96	0.99	0.98	293
33	0.95	0.96	0.95	341
34	0.97	0.98	0.97	355
35	0.97	0.98	0.98	373
36	0.96	0.98	0.97	317
37	0.98	0.99	0.98	371
38	1.00	0.98	0.99	307
39	0.99	0.99	0.99	361
40	1.00	1.00	1.00	261
41	0.97	0.98	0.98	260
accuracy			0.98	13810
macro avg		0.98	0.98	13810
weighted avg		0.98	0.98	13810

Figure 4.17: The Result of 8 Layer.

4.4.3 Database:

Databases enable the effective handling of massive amounts of data. It helps to assure the correctness and make updating data simple and trustworthy. It assists us in avoiding repetition and provide security measures to regulate access to information.

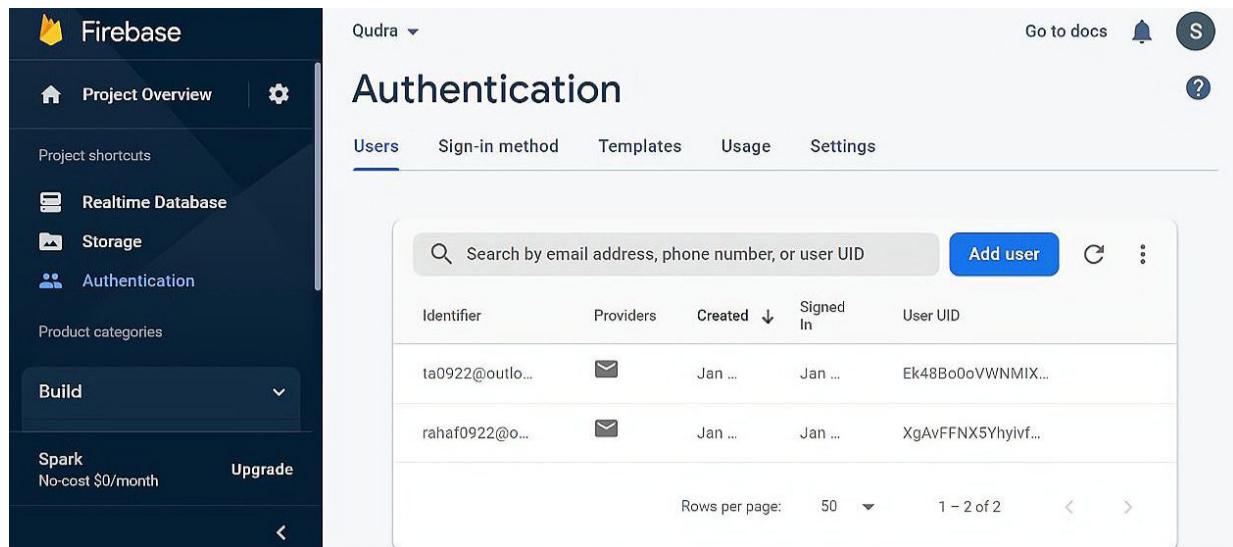
1-A real-time is a database system that manages workloads whose state is continually changing using real-time processing. This is distinct from conventional databases, which have permanent data that is largely time-insensitive.



The screenshot shows the Firebase Realtime Database interface. On the left, there's a sidebar with project settings like Project Overview, Storage, and Authentication. The main area is titled "Realtime Database" and has tabs for Data, Rules, Backups, and Usage. The Data tab displays a hierarchical tree view of database data. At the top level, there's a node for "https://kodra-ee9a0-default.firebaseio.com". Below it, there are two child nodes: "videoToText" and "wordToVideo". The "videoToText" node contains a single child "isChange: true". The "wordToVideo" node also contains a single child "isChange: true". Under each of these, there are three properties: "videoUrl", "word", and another unnamed property. The "videoUrl" for "videoToText" points to a URL on Firebase Storage. The "word" for "videoToText" is "z". The "videoUrl" for "wordToVideo" is empty, and its "word" is also empty. At the bottom of the interface, it says "Database location: United States (us-central1)".

Figure 4.18: The Real-Time Database.

2-Authentication offers ready-made UI libraries, simple SDKs, and backend services for user authentication in our app. It supports federated identity providers like Google, Facebook, and Twitter, as well as passwords, phone numbers, and other methods.



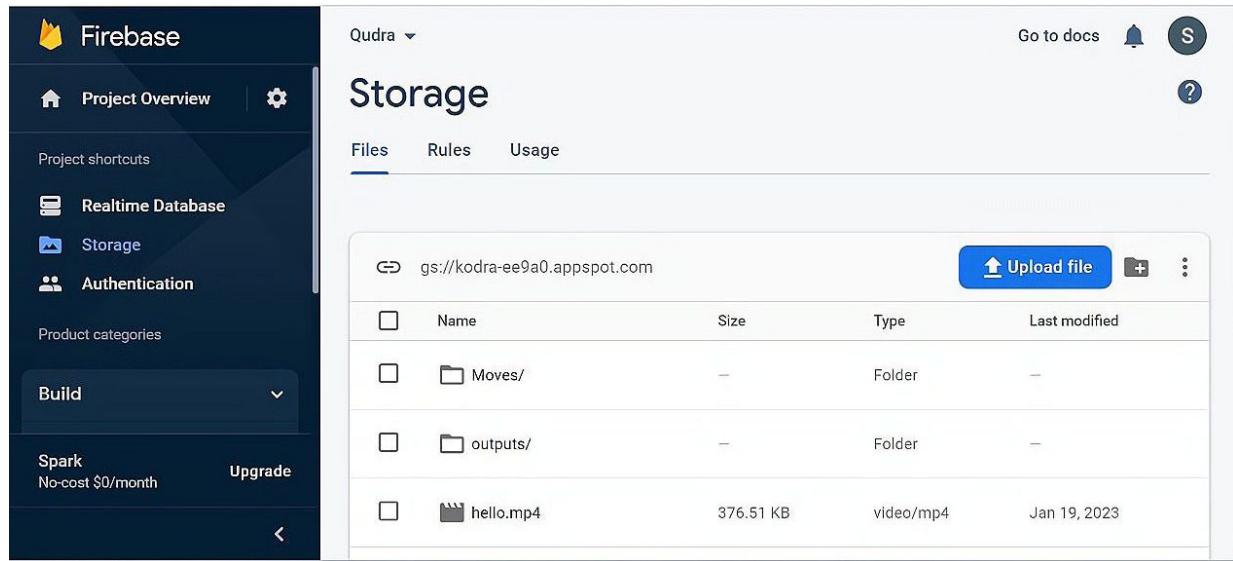
The screenshot shows the Firebase Authentication console. On the left, there's a sidebar with project shortcuts for Realtime Database, Storage, and Authentication. The main area is titled "Authentication" and has tabs for "Users", "Sign-in method", "Templates", "Usage", and "Settings". Below the tabs is a search bar and a blue "Add user" button. A table lists two users:

Identifier	Providers	Created	Signed In	User UID
ta0922@outlook.com	Email	Jan ...	Jan ...	Ek48Bo0oVWNMIX...
rahaf0922@outlook.com	Email	Jan ...	Jan ...	XgAvFFNX5Yhyivf...

At the bottom, there are pagination controls: "Rows per page: 50", "1 - 2 of 2", and navigation arrows.

Figure 4.19: The Authentication Database.

3-A storage is a service that stores objects that you may access through the Google Cloud Platform. You may quickly upload files using Google Firebase Storage, retrieve files through references, and keep track of work progress.



The screenshot shows the Firebase Storage interface. On the left, there's a sidebar with project shortcuts: Realtime Database, Storage, and Authentication. The main area is titled "Storage" and has tabs for "Files", "Rules", and "Usage". It shows a list of files under a bucket path: gs://kodra-ee9a0.appspot.com. The list includes:

<input type="checkbox"/>	Name	Size	Type	Last modified
<input type="checkbox"/>	Moves/	—	Folder	—
<input type="checkbox"/>	outputs/	—	Folder	—
<input type="checkbox"/>	hello.mp4	376.51 KB	video/mp4	Jan 19, 2023

At the top right, there are links for "Go to docs", a bell icon, and a user profile. At the bottom right of the table, there are buttons for "Upload file", "Add", and "More".

Figure 4.20: The Storage Database.

4.5 Testing

In this section, We have already appeared our application results in terms of user features and hearing impairment features. Figure 4.21 and 4.22 shows hearing impairment features. Figure 4.23 shows user features.

-Hearing Impaired :

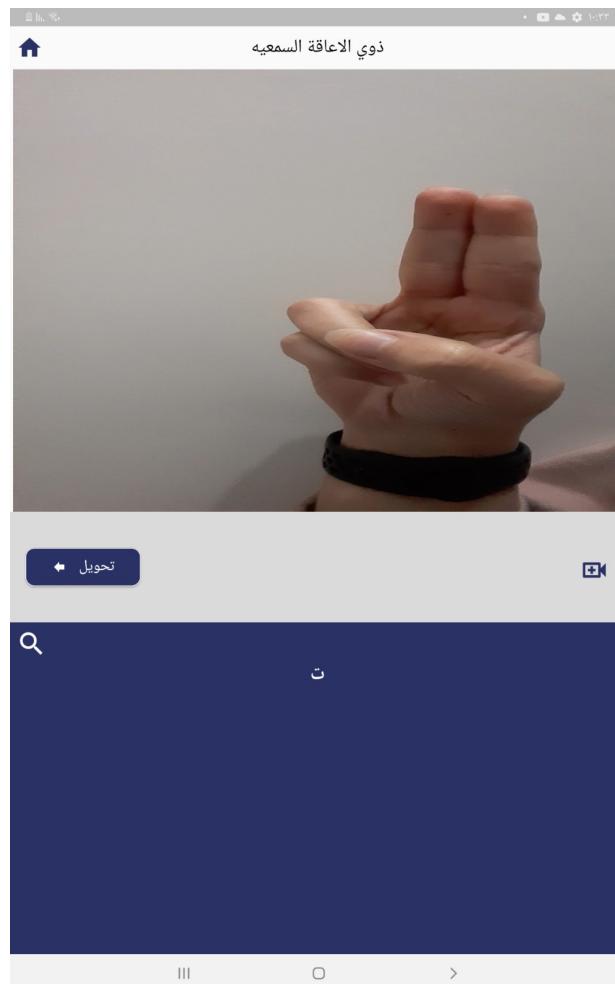


Figure 4.21: The Hearing Impaired Testing .

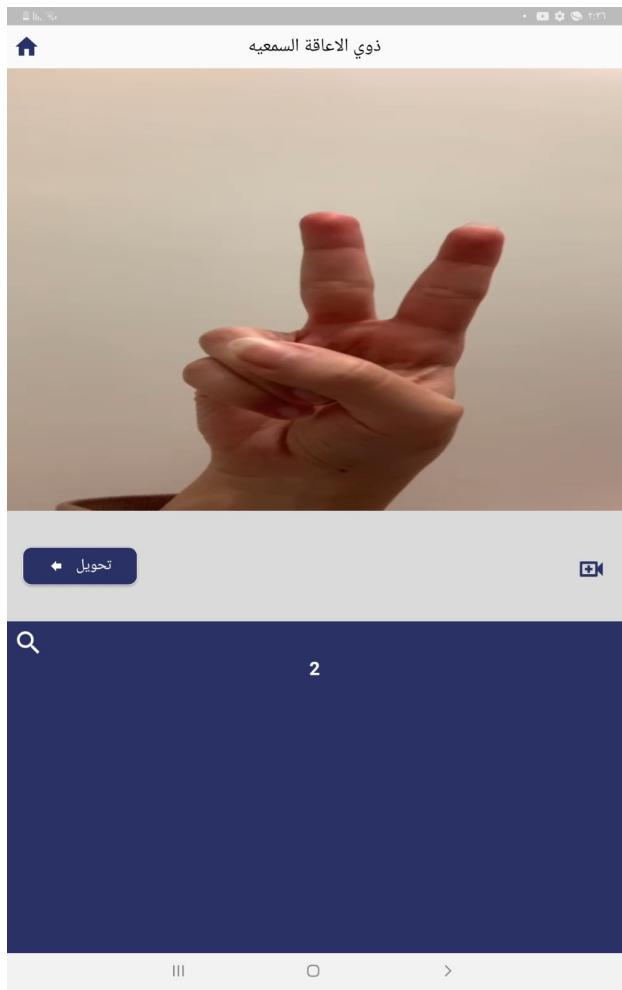


Figure 4.22: The Hearing Impaired Testing .

- User:

If the user enters input as the word (عن)، the output will be avatar movement on his chest as following

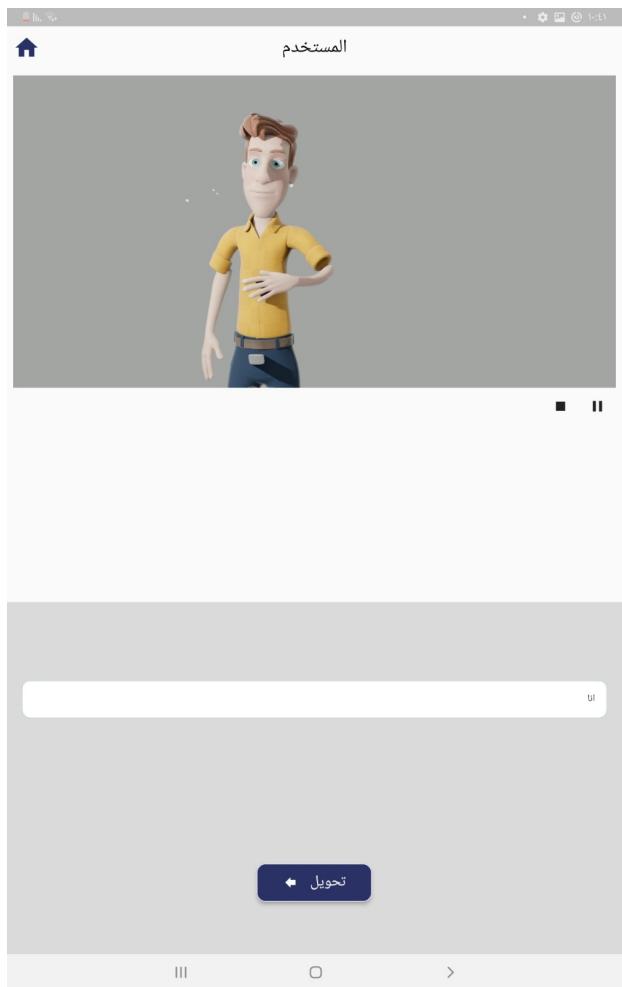
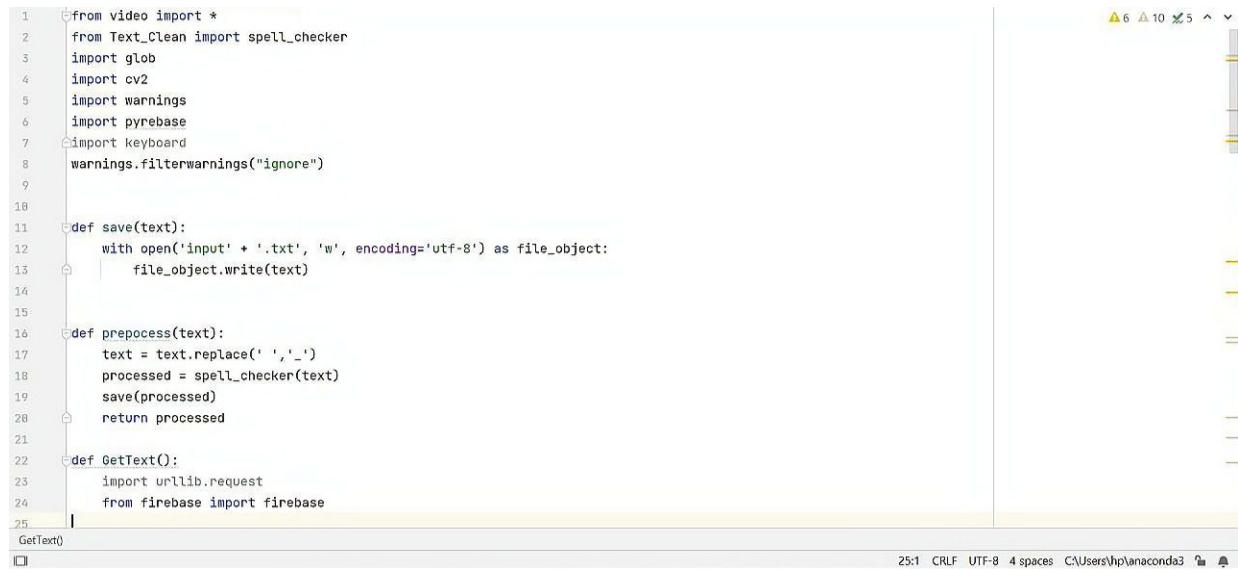


Figure 4.23: The User Testing .

4.6 Some Program Code

4.6.1 Python For Backend:

-Main for hearing impaired:



The screenshot shows a code editor window with Python code. The code imports various modules including video, Text_Clean, glob, cv2, warnings, pyrebase, and keyboard. It defines several functions: save, preprocess, and GetText. The save function writes processed text to a file. The preprocess function replaces commas with underscores, processes the text with a spell checker, saves it, and returns the processed text. The GetText function uses urllib.request and firebase to get text from a URL. The code ends with a call to GetText(). The status bar at the bottom indicates the file is 25:1 CRLF, UTF-8, 4 spaces, and the path is C:\Users\hp\anaconda3.

```
1  from video import *
2  from Text_Clean import spell_checker
3  import glob
4  import cv2
5  import warnings
6  import pyrebase
7  import keyboard
8  warnings.filterwarnings("ignore")
9
10
11 def save(text):
12     with open('input' + '.txt', 'w', encoding='utf-8') as file_object:
13         file_object.write(text)
14
15
16 def preprocess(text):
17     text = text.replace(',', '_')
18     processed = spell_checker(text)
19     save(processed)
20     return processed
21
22 def GetText():
23     import urllib.request
24     from firebase import firebase
25
GetText()
```

Figure 4.24: Main For Hearing Impaired

```

24     from firebase import firebase
25
26     firebase = firebase.FirebaseApplication('https://kodra-ee9a0-default.firebaseio.com')
27     return firebase.get('/wordToVideo/', 'word')
28
29
30 class mainVideo_Text:
31     def __init__(self):
32         print("text")
33         processed_text = preprocess(text)
34         print("text clean:", processed_text)
35         with open('input.txt', encoding='utf-8') as f:
36             lines = f.readlines()
37
38         path = ''.join([VideoMove.get(ENGTOARB.get(w)) for w in lines[0].split() if w in ENGTOARB])
39         if path == '':
40             path = './Other_rendering/*.jpg'
41         print(path)
42         files = sorted(glob.glob(path), key=lambda x: int(x.split("\\\\")[-1]))
43
44         # Load all Frame in This Array
45         img_array = []
46         for filename in files:
47             img = cv2.imread(filename)
48             height, width, layers = img.shape|
```

Figure 4.25: Main For Hearing Impaired

```

49         size = (width, height)
50         img_array.append(img)
51     # Output Path
52     vid_path = 'output.mp4'
53     out = cv2.VideoWriter(vid_path, cv2.VideoWriter_fourcc(*'XVID'), 12, size)
54
55     # Write Video
56     for i in range(len(img_array)):
57         out.write(img_array[i])
58     out.release()
59
60     return False
61
62     def UploadVideo():
63         firebaseConfig = {
64             "apiKey": "AIzaSyCbNNl00F0_PRDTo_KTNWQfSNSS5PvgDi0k",
65             "authDomain": "kodra-ee9a0.firebaseio.com",
66             "databaseURL": "https://kodra-ee9a0-default.firebaseio.com",
67             "projectId": "Kodra-ee9a0",
68             "storageBucket": "kodra-ee9a0.appspot.com",
69             "messagingSenderId": "646286184110",
70             "appId": "1:646286184110:web:989b17cde058f9b985e73f",
71             "measurementId": "G-RRR5Y10J48",
72             "serviceAccount": "serviceAccountKey.json"
73         }
74
75         UploadVideo()
```

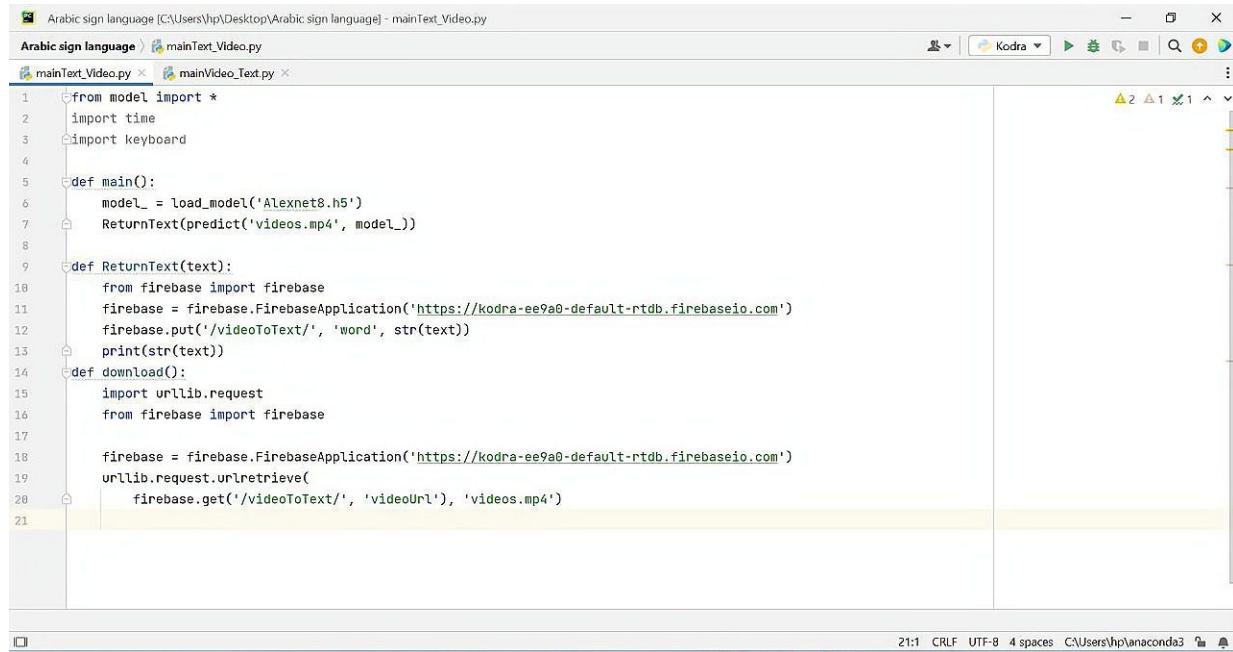
Figure 4.26: Main For Hearing Impaired

The screenshot shows a Python script named `mainVideo_Text.py` open in a code editor. The script uses the Pyrebase library to interact with a Firebase database. It starts by importing the `pyrebase` module and defining a configuration object with a measurement ID and service account key. It then initializes a Firebase application, creates a storage reference, and uploads a local MP4 file to it. Next, it signs in to a Firebase authentication account using email and password. After signing in, it retrieves the user's authentication token and generates a download URL for the uploaded MP4 file. Finally, it uses the Firebase Application interface to put the download URL into a specific database location. The code editor interface includes tabs for other files like `mainText_Video.py`, status indicators, and a bottom bar showing file statistics.

```
Arabic sign language [C:\Users\hp\Desktop\Arabic sign language] - mainVideo_Text.py
Arabic sign language > mainVideo_Text.py
mainText_Video.py mainVideo_Text.py
1   measurementId: "6-RRR5Y1B3J48",
2   "serviceAccount": "serviceAccountKey.json"
3 }
4 firebase = pyrebase.initialize_app(firebaseConfig)
5 storage = firebase.storage()
6 storage.child("output.mp4").put("output.mp4")
7
8 from firebase.firebaseio import FirebaseAuth, FirebaseApplication
9
10 email = "xxxx@gmail.com"
11 password = "xxxx"
12 authentication = FirebaseAuth(password,email)
13 firebase.authentication = authentication
14 user = authentication.get_user()
15 print(user.firebaseio_auth_token)
16
17 #user = auth.sign_in_with_email_and_password(email_,password)
18 url = storage.child("output.mp4").get_url(user.firebaseio_auth_token)
19 print(url)
20
21 firebase = FirebaseApplication('https://kodra-ee9a0-default-rtdb.firebaseio.com')
22 firebase.put('/wordToVideo/', 'videoUrl', str(url))
23 print(str(url))
24
```

Figure 4.27: Main For Hearing Impaired

-Main for User:



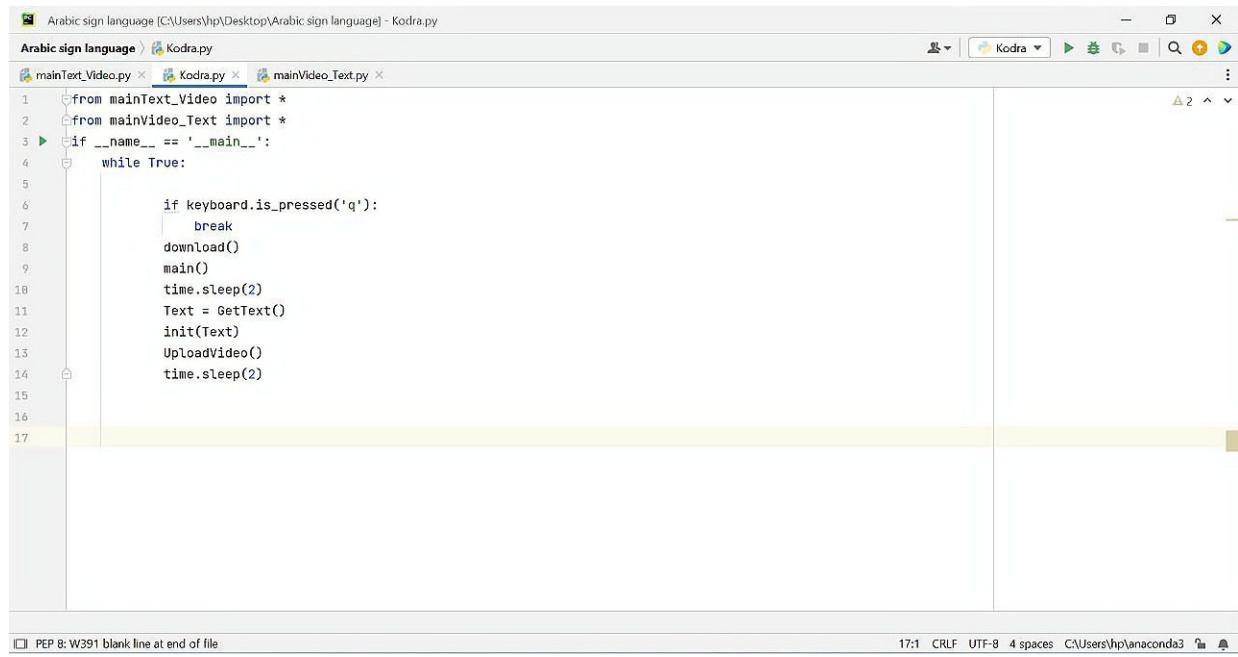
```
Arabic sign language [C:\Users\hp\Desktop\Arabic sign language] - mainText_Video.py
Arabic sign language > mainText_Video.py
mainText_Video.py x mainVideo_Text.py x

1 from model import *
2 import time
3 import keyboard
4
5 def main():
6     model_ = load_model('Alexnet8.h5')
7     ReturnText(predict('videos.mp4', model_))
8
9 def ReturnText(text):
10    from firebase import firebase
11    firebase = firebase.FirebaseApplication('https://kodra-ee9a0-default-rtdb.firebaseio.com')
12    firebase.put('/videoToText/', 'word', str(text))
13    print(str(text))
14 def download():
15    import urllib.request
16    from firebase import firebase
17
18    firebase = firebase.FirebaseApplication('https://kodra-ee9a0-default-rtdb.firebaseio.com')
19    urllib.request.urlretrieve(
20        firebase.get('/videoToText/', 'videoUrl'), 'videos.mp4')
21
```

21:1 CRLF UTF-8 4 spaces C:\Users\hp\anaconda3

Figure 4.28: Main For User

-Run for all the application :



The screenshot shows a Python code editor window titled "Arabic sign language [C:\Users\hp\Desktop\Arabic sign language] - Kodra.py". The editor displays two tabs: "mainText_Video.py" and "Kodra.py". The "Kodra.py" tab is active and contains the following code:

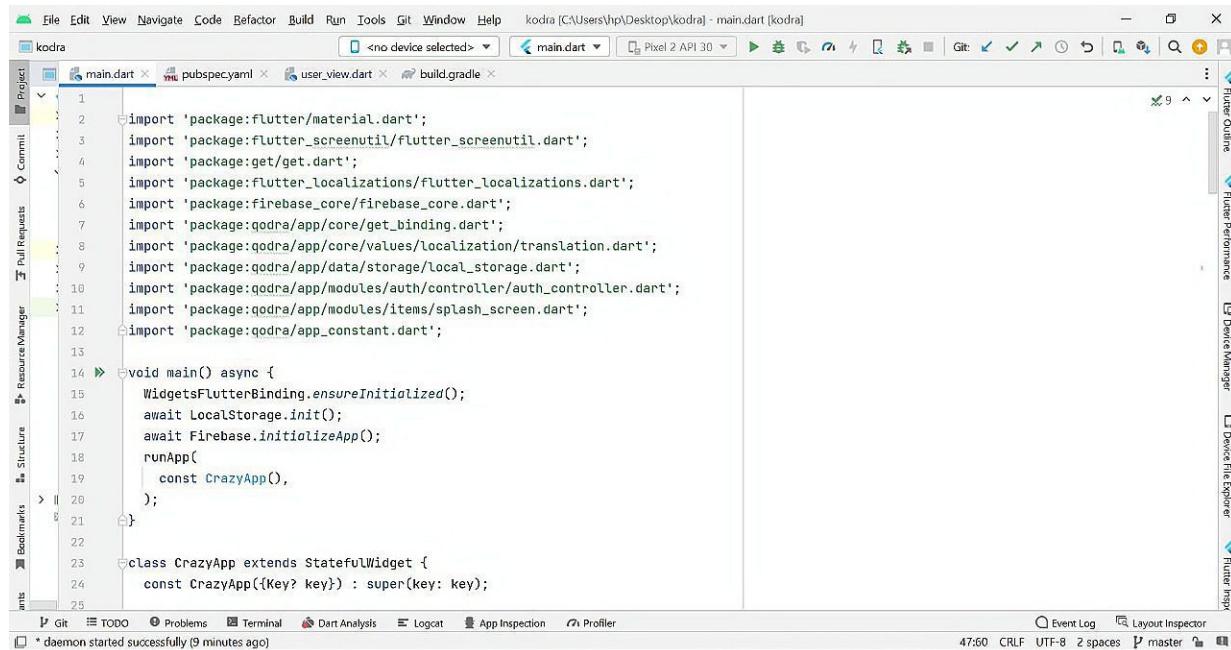
```
1  from mainText_Video import *
2  from mainVideo_Text import *
3  > if __name__ == '__main__':
4      while True:
5
6          if keyboard.is_pressed('q'):
7              break
8          download()
9          main()
10         time.sleep(2)
11         Text = GetText()
12         init(Text)
13         UploadVideo()
14         time.sleep(2)
15
16
17
```

The status bar at the bottom indicates "17:1 CRLF UTF-8 4 spaces C:\Users\hp\anaconda3".

Figure 4.29: Run for All The Application

4.6.2 Flutter For Frontend:

-The main:



```
import 'package:flutter/material.dart';
import 'package:flutter_screenutil/flutter_screenutil.dart';
import 'package:get/get.dart';
import 'package:flutter_localizations/flutter_localizations.dart';
import 'package:firebase_core/firebase_core.dart';
import 'package:qodra/app/core/get_binding.dart';
import 'package:qodra/app/core/values/localization/translation.dart';
import 'package:qodra/app/data/storage/local_storage.dart';
import 'package:qodra/app/modules/auth/controller/auth_controller.dart';
import 'package:qodra/app/modules/items/splash_screen.dart';
import 'package:qodra/app_constant.dart';

void main() async {
    WidgetsFlutterBinding.ensureInitialized();
    await LocalStorage.init();
    await Firebase.initializeApp();
    runApp(
        const CrazyApp(),
    );
}

class CrazyApp extends StatefulWidget {
    const CrazyApp({Key? key}) : super(key: key);
```

Figure 4.30: Flutter Main

```
const CrazyApp({Key? key}) : super(key: key);

@Override
State<CrazyApp> createState() => _CrazyAppState();

class _CrazyAppState extends State<CrazyApp> {
  @override
  Widget build(BuildContext context) {
    Get.lazyPut(()=>AuthController());
    final navigatorKey = GlobalKey<NavigatorState>();
    return Directionality(
      textDirection: LocalStorage.isAr ? TextDirection.rtl : TextDirection.ltr,
      child: GetMaterialApp(
        navigatorKey: navigatorKey,
        debugShowCheckedModeBanner: false,
        localizationsDelegates: const [
          GlobalMaterialLocalizations.delegate,
          GlobalWidgetsLocalizations.delegate,
          GlobalCupertinoLocalizations.delegate,
        ],
        supportedLocales: const [
          Locale('en', 'US'), // include country code too
          Locale('ar', 'SA'), // include country code too
        ],
      );
  }
}
```

Figure 4.31: Flutter Main

```
// locale: Locale('ar', 'EG'),
defaultTransition: Transition.cupertino,
transitionDuration: const Duration(milliseconds: 500),
translations: Translation(),
initialBinding: GetBinding(),
locale: LocalStorage.isAr ? const Locale('ar') : const Locale('en'),
fallbackLocale: const Locale('en'),
title: 'Qodra',
themeMode: ThemeMode.light,
home: const SplashScreen(), // GetMaterialApp
); // Directionality

ThemeData lightThemeData(BuildContext context) {
  return ThemeData.light().copyWith(
    primaryColor: const Color(0xFF5B4B49),
    colorScheme: ColorScheme.fromSwatch()
      .copyWith(secondary: const Color(0xFF24A751));
}

// dark Theme
ThemeData darkThemeData(BuildContext context) {
  return ThemeData.dark().copyWith(
    primaryColor: const Color(0xFFFF1D00),
}
```

Figure 4.32: Flutter Main

The screenshot shows the Kodra IDE interface with the main.dart file open. The code defines a light theme with a primary color of #FFF1000 and a color scheme from a swatch. It includes a hint style for text input and a primary text theme for titles and subtitles. The code is annotated with comments indicating styling like regular font families and specific colors.

```
primaryColor: const Color(0xFFFF1000),
colorScheme: ColorScheme.fromSwatch()
    .copyWith(secondary: const Color(0xFF24A751));

ThemeData getLightTheme() {
  return ThemeData(
    // fontFamily: fontFamily.regular,
    scaffoldBackgroundColor: kBackgroundDarkColor,
    platform: TargetPlatform.iOS,
    inputDecorationTheme: InputDecorationTheme(
      hintStyle: TextStyle(
        fontSize: 20.sp,
        // fontFamily: fontFamily.regular,
        color: Colors.white), // TextStyle
      errorStyle: TextStyle(
        fontSize: 18.sp,
        // fontFamily: fontFamily.regular,
        color: Colors.red), // TextStyle, InputDecorationTheme
    primaryTextTheme: TextTheme(
      titleMedium: TextStyle(
        fontSize: 14.sp,
        fontWeight: FontWeight.w700,
        // fontFamily: fontFamily.regular,
        // color: colorPrimary
```

Figure 4.33: Flutter Main

The screenshot shows the Kodra IDE interface with the main.dart file open. The code defines a dark theme with a primary color of #FFF1000 and a color scheme from a swatch. It includes a hint style for text input and a primary text theme for titles and subtitles. The code is annotated with comments indicating styling like regular font families and specific colors.

```
// color: colorPrimary
    ), // TextStyle, TextTheme
  primarySwatch: Colors.green,
  elevatedButtonTheme: const ElevatedButtonThemeData(),
  appBarTheme: AppBarTheme(
    backgroundColor: kBackgroundDarkColor,
    centerTitle: true,
    elevation: 0), // AppBarTheme
  toggleableActiveColor: kPrimaryColor,
  highlightColor: Colors.transparent,
  splashColor: Colors.transparent,
); // ThemeData

ThemeData getDarkTheme() {
  return ThemeData(
    // fontFamily: fontFamily.regular,
    scaffoldBackgroundColor: kBackgroundDarkColor,
    platform: TargetPlatform.iOS,
    inputDecorationTheme: InputDecorationTheme(
      hintStyle: TextStyle(
        fontSize: 20.sp,
        // fontFamily: fontFamily.regular,
        color: Colors.black), // TextStyle
      errorStyle: TextStyle(
```

Figure 4.34: Flutter Main

The screenshot shows a code editor interface with the following details:

- File Path:** kodra / lib / main.dart
- Code Editor Content:** The main.dart file contains Dart code defining a theme for a Flutter application. The code includes definitions for primaryTextTheme, primaryTextTheme, primarySwatch, and appBarTheme.

```
errorStyle: TextStyle(
    fontSize: 18.sp,
    // fontFamily: FontFamily.regular,
    color: Colors.black), // TextStyle, InputDecorationTheme
primaryTextTheme: TextTheme(
    titleMedium: TextStyle(
        fontSize: 14.sp,
        fontWeight: FontWeight.w700,
        // fontFamily: FontFamily.regular,
        // color: colorPrimary
    )), // TextStyle, TextTheme
primarySwatch: Colors.orange,
elevatedButtonTheme: const ElevatedButtonThemeData(),
appBarTheme: AppBarTheme(
    backgroundColor: kBackgroundDarkColor,
    centerTitle: true,
    elevation: 0), // AppBarTheme
toggleableActiveColor: kPrimaryColor,
highlightColor: Colors.transparent,
splashColor: Colors.transparent,
);
}); // ThemeData
```

- Toolbars and Menus:** Standard file menu (File, Edit, View, Navigate, Code, Refactor, Build, Run, Tools, Git, Window, Help) and a toolbar with various icons for navigation and file operations.
- Side Panels:** Project, Git, TODO, Problems, Terminal, Dart Analysis, Logcat, App Inspection, Profiler, Event Log, Layout Inspector, Device Manager, Device File Explorer, and Flutter Inspector.
- Status Bar:** Shows the message "daemon started successfully (12 minutes ago)", file statistics (143:1 CRLF, UTF-8, 2 spaces), and a master branch indicator.

Figure 4.35: Flutter Main

5 Conclusion and Future Works

5.1 Conclusions

Qudra application is Android app. It supports the hearing impaired to make their daily lives easier. We spent a lot of time and work achieving our goal. We presented the Qudra app with all properties and features that support our goal and show the appropriate form as we see now. The main components that made the Qudra app appear in a suitable way are as follows:

1. Using a programming language for example we used python for a backend and flutter for a frontend and also used a firebase for the database.
2. Using a real dataset.
3. Utilizing deep learning algorithm e.g. we used CNN algorithm.
4. Evaluating our algorithm using the confusion matrix.
5. Getting the best result for the algorithm accuracy.
6. Achieving our main goal of the Qudra app which is helping the hearing impaired.

Deep Learning and Artificial Intelligence play a major role in building the Qudra app. We used Arabic Alphabets Sign Language Dataset (ArASL)2018. It consists of 54,049 images of ArSL alphabets performed by more than 40 people for 32 standard Arabic signs and alphabets. We utilized the CNN model where this model is especially useful for finding patterns in images to recognize objects, classes, and categories. Applying CNN model with parameters on 5 and 8 layers. We have already three fully connected layers on 8 layers. However, we got the same result of accuracy for 5 and 8 layers which is 0.98.

It is worth noting that, the software that was used in our application PyCharm. It is an integrated development environment that works in the field of programming in the Python language. In addition to this, we used Android Studio which considers the official Integrated Development Environment (IDE) for Android app development. The main reason to use this app is that has new tools for developing applications. Also, it can provide an alternative to Eclipse, which is the most widely used IDE at the current time.

Finally, the Qudra application has achieved the goal of helping the hearing impaired communicate with the community. The Qudra application is a new future in Arabic applications for the hearing impaired.

5.2 Recommendations

We have some recommendations as follows:

1. We recommend people be aware of the importance of downloading this application.
2. The adoption of the application by the Authority for Care of Persons with Disabilities and also the Ministry of Health to limit hearing-impaired problems.

5.3 Future Works

The application will be expanded and developed. Although the application has achieved the goal of helping the hearing impaired to communicate with the community, it needs to add some improvements in the future:

- Upgrading the operating system to include the IOS version.
- Increasing the number of words in sign language.
- Supporting the voice feature.
- Making this app to support the visually impaired.

- Increasing the efficiency of the application and improving its performance.
- Adding a female virtual character.
- The possibility of translating clips into sign language or translating sign language clips into sentences.
- Usage of many different deep learning algorithms.

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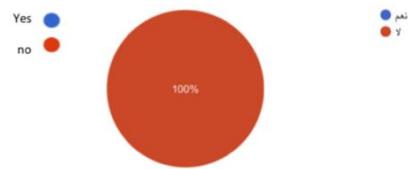
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Appendix A: Questionnaire

1. Questionnaire to measure the difficulties of communicating people, with hearing-impaired

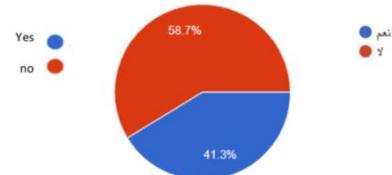
Are you one of the people with special needs(hearing impairments)?
هل انت ضمن فئة ذوي الاحتياجات الخاصة (اعاقة سمعية)؟

رداً 63



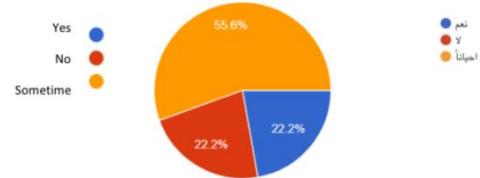
Are you know someone a one of the people with special needs(hearing impairments)?
هل أحد أقاربك او معارفك ضمن فئة ذوي الاعاقة السمعية؟

رداً 63



Do you have difficulty communicating with people with special needs(hearing impairments)?
هل يوجد صعوبة في فهم احتياجات ومتطلبات ذوي الاعاقة السمعية؟

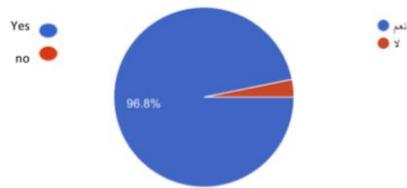
رداً 63



Do you want apps that facilitate the communication with people with special needs?

هل ترغب بتطبيق يسهل تواصلك وفهمك لفئة ذوي الاعاقة السمعية؟

رداً 63



What's the important difficult of people with special needs?

ما هي اهم المصاعب التي تواجهها تجاه هذى الفئة؟

رداً 63

can't understand or help them

عدم القدرة على فهمهم ومساعدتهم

sign language

لغات الاشارة

difficult to understand the who cannot speaking or hearing

صعوبة الفهم على من لا يستطيع الكلام او السمع

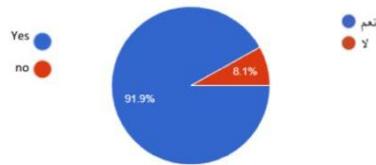
I don't know how i deal with them

عدم معرفة التعامل معهم

2. Questionnaire to measure the daily needs of people with hearing-impaired

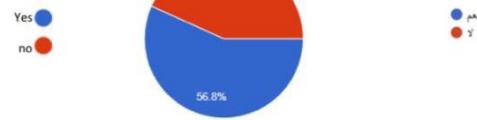
Are you one of the people with special needs(hearing impairment)?
هل انت ضمن فئة ذوي اعاقة سمعية؟

رداً 74



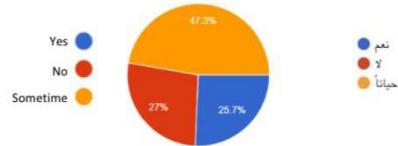
Do you face difficulty in the educational environment,
such as communicating with your classmates which
they're don't have special need?
هل تواجه صعوبة في البيئة التعليمية كالتواصل مع زملائك من الفئة الطبيعية؟

رداً 74



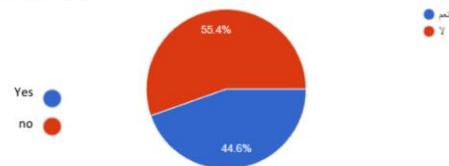
As person with hearing impairments do you have difficulty
to communicate with Community?
كما شخص ذو اعاقة سمعية هل هناك صعوبة بالتواصل مع المجتمع؟

رداً 74



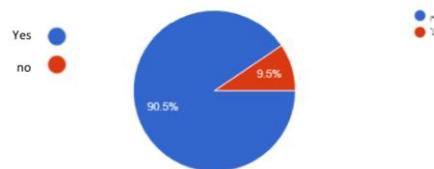
هل يوجد تطبيق يساعد جميع افراد المجتمع بالتوصل معك وفهم احتياجاتك في الاماكن العامة او التعليمية او الترفيهية؟
رداً 74

Are there's apps help all people in community to communicate with you on public place or education or Places of entertainment?



هل ترغب بتطبيق سهل تواصلك وطلب احتياجاتك مع جميع افراد المجتمع؟
رداً 74

Do you want apps that help you to communication with all people in community and ask them for your needs?



ما هي اكبر مشكلة تواجهك عند التواصل مع افراد المجتمع؟
رداً 74

what is the difficulties you suffer when you communication with other people on community?

Speaking quickly and don't use sign language

التحدث بسرعة وعدم استخدام لغة الاشارات

We not clearly understand and they do not know the sign language and there is no translator

مانقهم جيداً ويعارفون اشارات ولا يتوفرون مترجمين

Most people on community they don't not know the sign language

اكثر افراد المجتمع لا يعرفون لغة الاشارات