Educational website for learning sign language

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Last but not least, we would also like to thank our parents and who helped us a lot in finalizing this project within the determined time frame.

DECLARATION

I hereby certify that this work, which I now submit for assessment on the program of study leading to the award of Bachelor of Science in *(insert title of degree for which registered)* is entirely my own work, that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others and to the extent that such work has been cited and acknowledged within the references section of this report.

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ABSTRACT

Hearing disability is one of the familiar phenomena throughout the ages, and hardly a society is devoid of it, as this phenomenon is a

topic that combines the interests of many fields of science and knowledge, such as psychology, education, medicine and society, due to the multiplicity of practical bodies that contributed to the explanation of this phenomenon and the difference of hearing disability in the child is either deaf or hard of hearing.

Many deaf and dumb people have difficulty communicating, and because this category needs everyone to learn their own language, we will try to solve this problem and make a site that aims first to measure the impressionistic level of individuals when first acquainted with sign language as well as specialized tests and courses in this field.

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CHAPTER 1: INTRODUCTION TO SIGN LANGUAGE

The creation of sign language helped close the communication gap between those who can hear and those who cannot for persons who have lost their hearing or are hearing impaired. The use of sign language, which consists of a variety of hand movements and symbols, allows the deaf and hard of hearing to engage with their environment.

Anyone interested in being able to communicate with people who are hearing impaired should learn and comprehend sign language. Sign language is not just for people who are deaf. Learning sign language is not difficult, and studies show that there is an increasing need for sign language users in the workplace and globally. To meet this need, some schools and institutions have created degree programs in sign language.

Here some examples of sign language:

- **Hand movements:** like fingers to spell numbers and letters.
- **Facial expressions:** to convey feelings and inclinations. It is associated with the movements of the hands to give the structures of many meanings.
- **Lip movements:** This is an advanced stage of the power of observation, as the deaf reads the words directly from the lips.

Body movement: such as placing some signs on the shoulders or the top and sides of the head or chest and abdomen in suggestive use to clarify desires and meanings, in general for self-expression, and it differs from one country to another.

1.1. Problem Definition

Deaf and dumb people have a lot of difficulties. Imagine that you live in a world where no one knows your language and you have to navigate everyday life using interpreters and special services to help you communicate with others. Imagine a world where everyone is deaf and you are the only one who hears it and you are excluded because of your "hearing" disability And you are classified as "another type." This is the reality of the deaf community

There are approximately 1.4 million deaf and hard of hearing people living in the USA within the state of Michigan and more than 38 million deaf and hard of hearing people all over the other America, where the deaf community is a vibrant but unfortunately incredibly marginalized community from Before the mainstream audio community

Deaf people endure daily discrimination and oppression. Deaf people have faced generations of systematic discrimination including forced sterilization in the twentieth century. The relationship between the hearing community and the deaf community is often strained due to the continuing lack of understanding of the deaf community. Therefore, we wanted to make a site to teach sign language easily from home to help spread sign language in the world and the ordinary person can learn sign language, not just the deaf person, so that we are able to understand each other easily in the world.

1.2. Background and Related Work

1.2.1. ASL App:

1.2.1.1. Problem Definition:

We think it's crucial to connect communities, particularly in areas with sizable and vibrant Deaf & signing populations. People who are Deaf frequently ask us, "Where can I learn ASL?"

We intended to make learning ASL really simple, available, and enjoyable rather than having to deal with complicated information dispersed around the internet. We were motivated to develop the app as a means for our friends who refuse to join to do so. In order for friendships to develop, more dialogues, and ideas to arise!

1.2.1.2. Introduction about the project:

You may learn American sign language easily and step-by-step with the help of the ASL App. With more than 2,500 signs and sentences, simple navigation and features, and a variety of signers, The ASL App is made to make learning simple, approachable, and enjoyable.

The program is quite user-friendly and has features like a search index, a slow-motion option, hints, and a favorites folder where you may save the signs you wish to practice and return to them later. Because we want the learning process to seem natural, we invested a lot of time and passion into creating this product.

Figure 1.1: ASL-app-logo

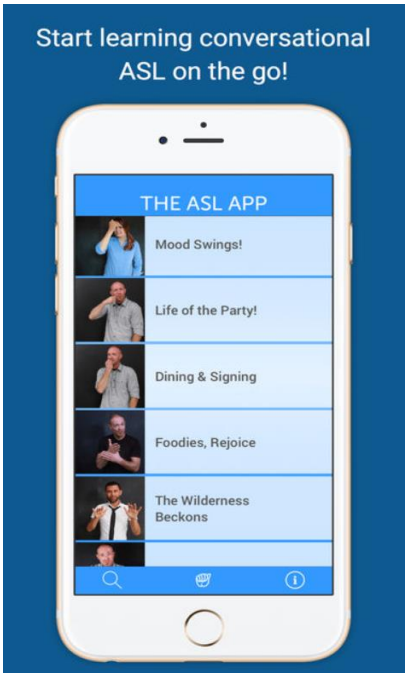


Figure 1.2: ASL-app

1.2.1.3. Advantages:

1. This is made to be used one-handedly and while you're on the go.
2. The idea is to get you moving and give you the confidence to strike up a conversation with a deaf person.

1.2.1.4. Disadvantages:

1. The issue is that you can't choose a single letter to practice because they go through the full alphabet at once. Furthermore, the entire scenario is repeated back to A if you want it to repeat a certain letter. And a "pause" button is absent. This is incredibly irritating for learning.
2. The only way to see a list of all the phrases in a section is to flip through each one individually.

1.2.2. ASL PRO Web:

1.2.2.1. Problem Definition:

Many deaf and dumb people have difficulty communicating, and because this category needs everyone to learn their own language, the site offers a lot of lessons about finger, words and phrases in sign language.

1.2.2.1. Introduction about the project:

Great site to learn ASL on their website, you can find great educational tools you can learn everything from the alphabet, to everyday words and phrases and more, the site is completely free to use.

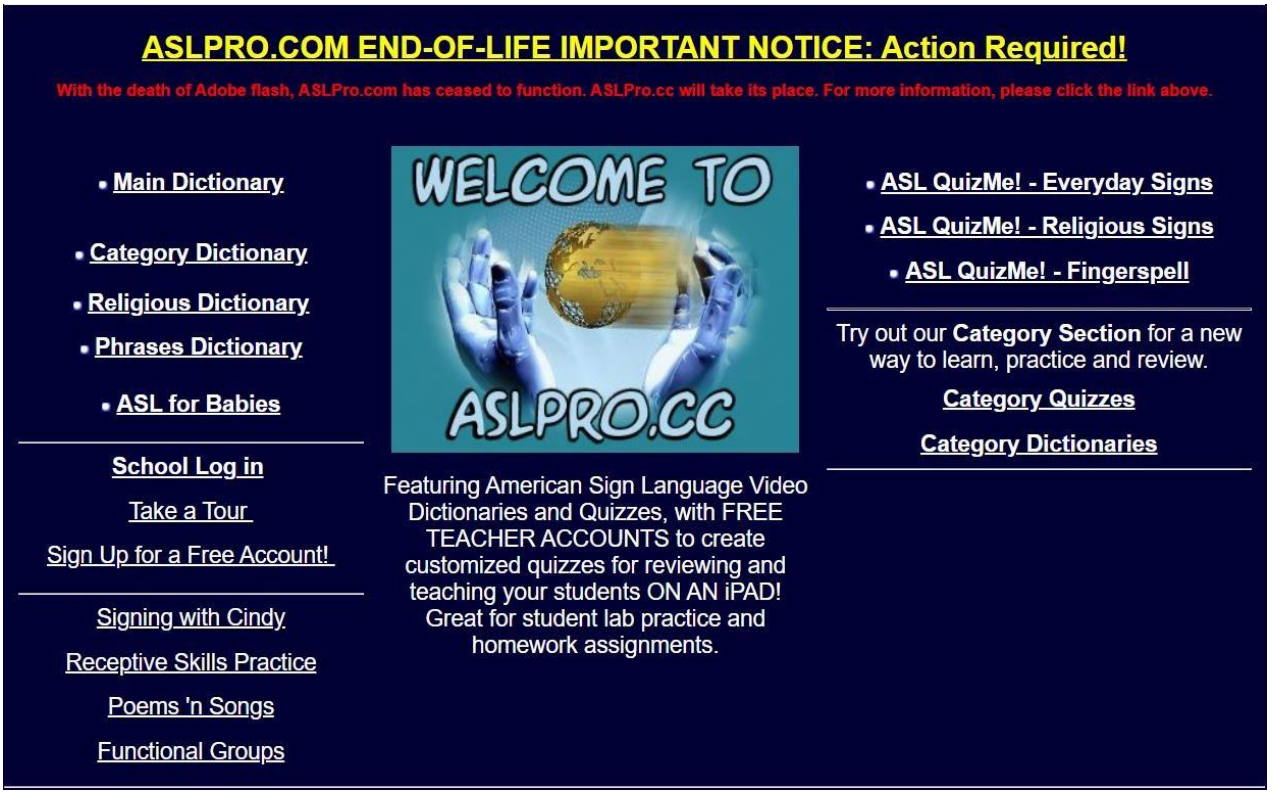


Figure 1.3: ASL-Pro-Web

1.2.2.2. Advantages:

It contains a lot of information, sign language dictionaries, quizzes, educational games, they also have sections on ASL for kids, religious signs, singing, the site is free to use .

1.2.2.3. Disadvantages:

1. Face the site difficult to use
2. when you do the test does not give you the correct response to your answers Learning is limited and not everything you want.

1.2.3. Sign Language 101:

1.2.3.1. Problem Definition:

Learning sign language is one of the most important things we must do, if you are an employee or a student, you can meet someone who is deaf and in this case you will not be able to deal with them.

1.2.3.2. Introduction about the project:

SIGN LANGUAGE 101 is one of the most popular sites for teaching sign language in American English, offering us courses and books to facilitate learning for learners. Dr Byron Bridges offers us American Sign Language (ASL) courses for adults at two full levels Level I and Level II. In addition to a sign language course for children.

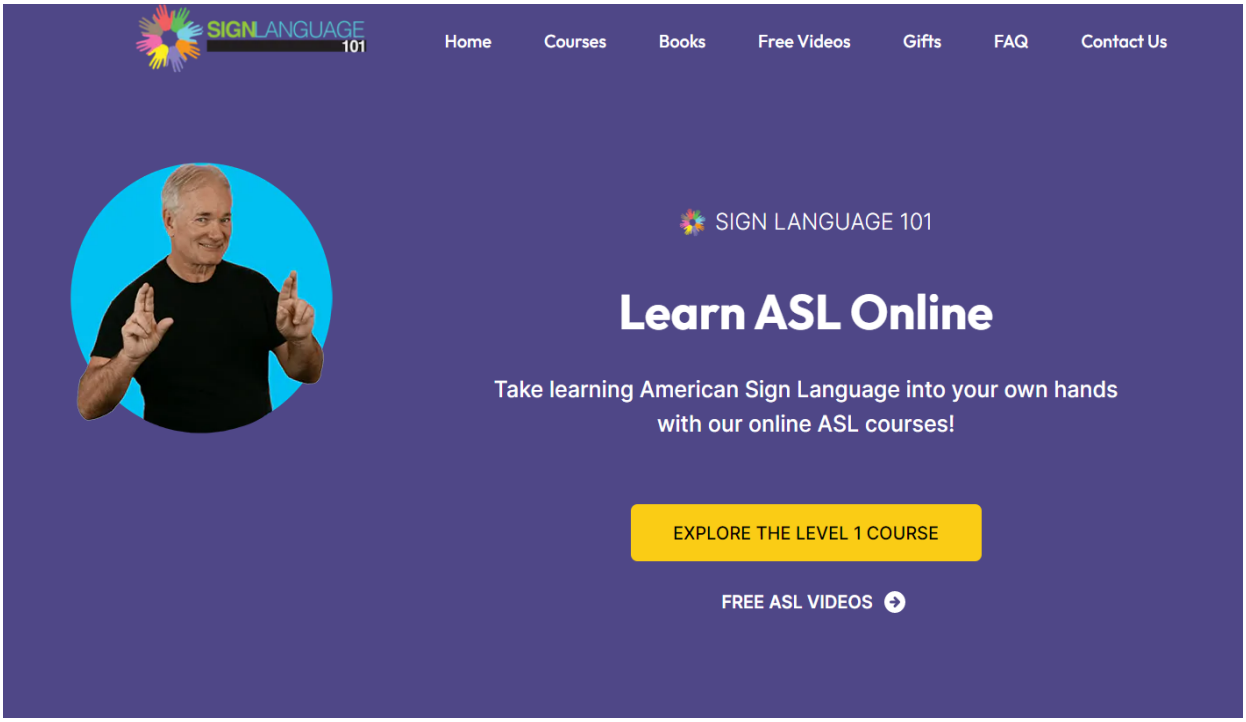


Figure 1.4: ASL-101

1.2.3.3. Advantages:

Each lesson is divided into small-scale lectures and includes activities and exercises for further training. Both levels have been designed for 10 weeks to facilitate learning. These courses were created by deaf specialists, Face the site EASY to use.

1.2.3.4. Disadvantages:

1. Not all sign language courses in American English are available for free, but some are free.
2. Learning is limited and not everything you want.

1.2.4. Start ASL:

1.2.4.1. Problem Definition:

If you're looking to learn sign language at home, you have some of the best places to learn sign language online, and before you embark on it you have to familiarize yourself with some of the traditional methods of learning sign language, so you can get an idea of how to teach it naturally.

1.2.4.2. Introduction about the project:

Start ASL offers us multiple options to choose from that suits you, you can choose the courses section in case you are a student who wants to learn sign language. You can also choose the School Options section in case you are a teacher, school, home school or organization.

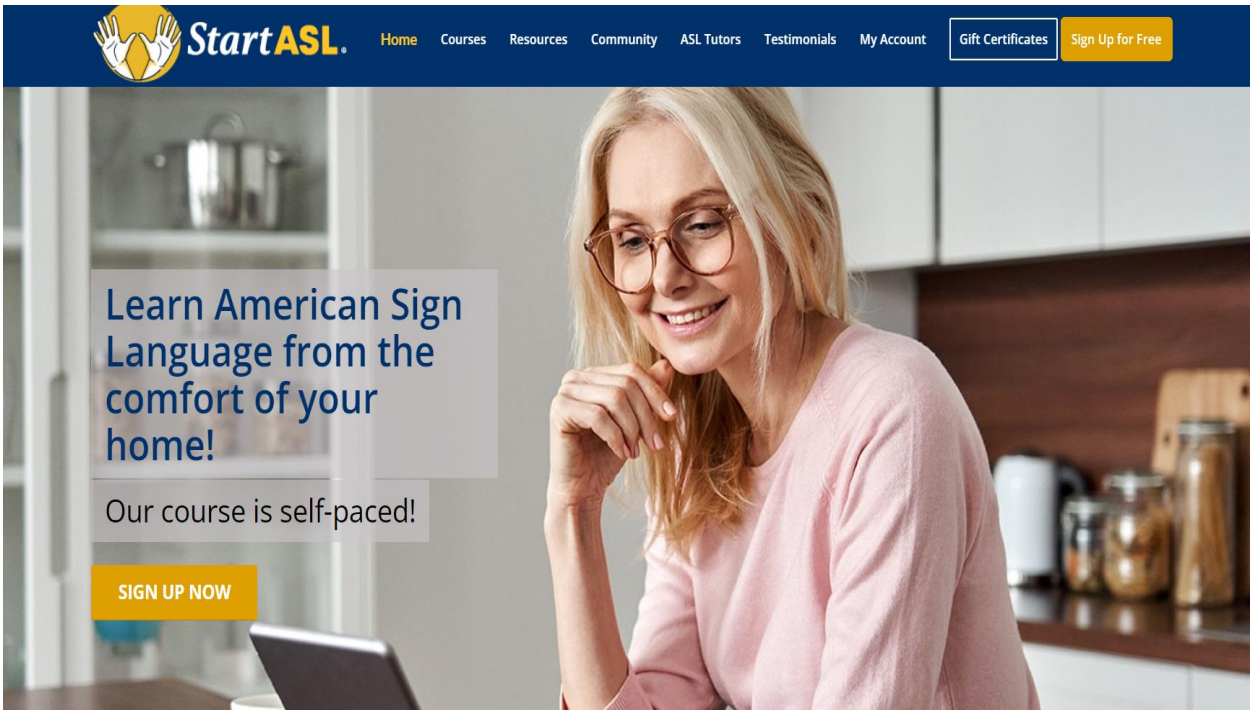


Figure 1.5: Start-ASL

1.2.4.3. Advantages:

1. Free Lessons: It contains more than 170 video tutorials presented by 9 lecturers, more than 1100 words of American English vocabulary, as well as basic ASL grammar lessons to become one of the most important sources of sign language learning from scratch.

2. Face the site EASY to use.

1.2.4.4. Disadvantages:

3. Not all American English sign language courses are available for free
4. Learning is limited and not everything you want.

1.3. System Objective and Motivation

1.3.1. Objectives:

You may communicate with a variety of hearing, hard-of-hearing, and deaf people by learning sign language, including students in mainstream and deaf school or university programs, deaf or hard-of-hearing locals, and businesspeople.

We may classify research goals into the many main categories listed below:

1. Students will have the foundational vocabulary and grammar for communicating at the beginner level.

2. Anyone will be able to access the site and learn sign language.

3. It will make it easier for students to learn sign language from their homes without having to go to specialized centers to teach sign language.

4. The site will make a quiz for the student after the end of each course he studies.

5. Students will be able to distinguish slowly written and signed numerals as well as rudimentary fingerspelling of the numbers.

1.3.2. Motivation:

There are many people and some families who have children, friends or some relationships who suffer from hearing disabilities and face some difficulties in communicating with each other, due to the inability of some to go to centers designated to learn sign language, due to the distance of these centers or their unavailability in neighboring areas To them or to the high cost of learning sign language in some centers.

People who are Deaf or hard of hearing frequently use sign language as their primary means of communication, yet sign languages have a lot to offer to everyone. Look at these things:

1. Possibility to interact with the Deaf community.
2. It is the language that Deaf and hard of hearing individuals can use the most easily.

1.4. System Architecture

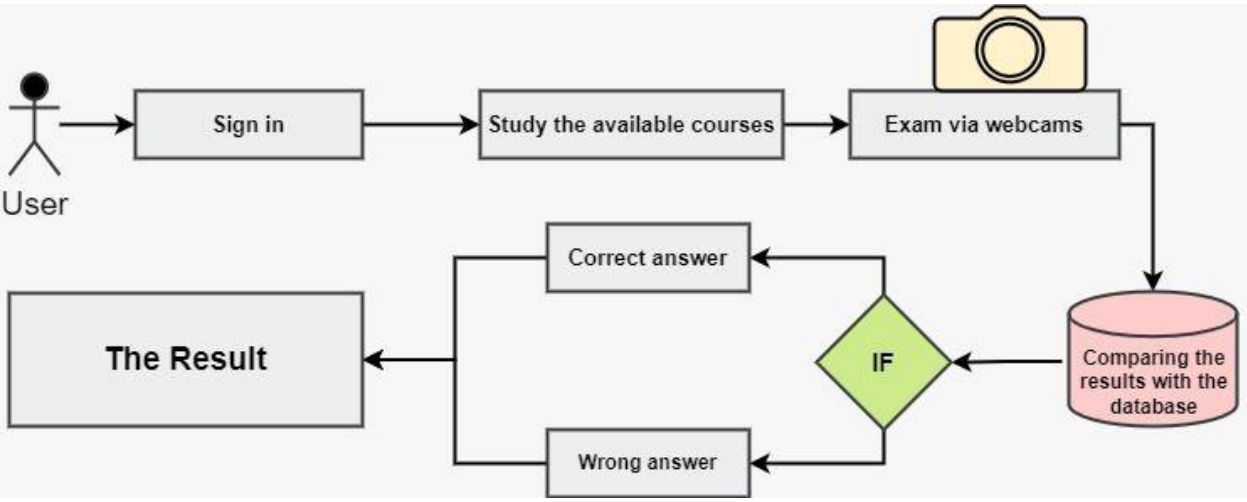


Figure 1.6: flow chart

1.4.1. System Actors:

Term	Definition
Administrator	A person who has a full control on the web application
user	A person who has an account on the system

1.5. System Requirements

1.5.1. Functional Requirements:

1. User Interface: The user interface requirements are concerned with the user interface and how information is presented to the user.
2. Logging: The user's password must never be exposed to compromise.
3. **Hand movements recognition:**
    - **Description:** By utilizing computer inputs, the program must identify the wordless user's hand motions.
    - **Source:** Leap motion and inventive camera sensors.
    - **inputs:** Stream data.
    - **Outputs:** According to the recognized gesture, the database index.
    - **Destination:** Local machine.
    - **Action:** The user must position themselves in front of the camera or above the action of the leap. He uses hand motions to connect with the computer. The sensors detect the movements, and they provide the information to the software. It was analyzed by the algorithm, which also calculated which sign language movement it is.
    - **Prerequisite:** Ambient light should be sufficient to properly observe the user's motions while using the Creative Camera. Hands should be above the sensor when performing the jump action. The database contains a copy of the recognized gesture.
    - **Post-condition:** It has been successfully identified the user's hand movement.

- **Consequences:** Ineffective gesture recognition.

4. **Literal translation:**
    - **Description:** The website must display the term or concept that relates to the user movement that was detected on the screen.
    - **Inputs:** Data processed by our algorithm as well as a database of sign language gestures serve as inputs.
    - **Source:** The local computer's hard disk.
    - **Result:** String.
    - **Destination:** The screen.
    - **Action:** The software examines the database for the literal translation that corresponds to the gesture it has just identified.
    - **Prerequisite:** The data base contains the identified gesture's literal translation.
    - **Post-condition:** The literal translation appears on the screen as intended.
5. **Self-learning:**
    - **Description:** Discover a fresh sign language motion.
    - **Inputs:** Data stream inputs
    - **Source:** A local computer
    - **Outputs:** New database index is produced.
    - **Destination:** Local machine

- **Action:** If the gesture is not detected, the software should suggest that the user input the literal translation for that motion. The software then creates a new record in the database.

- **Post-condition:** The database receives a new entry matching to the unidentified gesture.

1.5.2. Non- Functional Requirements:

1. **Real-time** recognition should be possible. (3 maximum seconds).
2. **Security:** The account management system shall only be used by managers or users.
3. **Reliability:** The system shall have reliability and the system shall generate error messages when the user attempts to enter invalid data.

1.6. Expected Outcomes

The site will be dynamic that will interact with the user in more than one way as the site offers to choose from a variety of course options on the website based on what suits you best. The website enables you to take the course for free whether you are a student or someone who wants to learn sign language.

In addition, at the conclusion of each lesson, a quiz will be created using the device's camera and some topics that you have already learned. Immediately after each question, the course will indicate whether the movement is correct or incorrect, provide the appropriate answer and assess how much you have learned from the course.

1.7. Proposed S/W and H/W Tools

1.7.1. Software Tools:

AI:

- Python
- TensorFlow
- Keras
- OpenCV

Web:

- HTML
- CSS
- JavaScript

Database:

- SQL

Front End:

- HTML – JavaScript – CSS

Back End:

- Python

1.7.2. Hardware Tools:

There is no hardware Tools.

Chapter 2: System Analysis and Design

2.1. Overview

The analysis phase takes the general ideas in the business requirements and refines them into a detailed requirements definition, functional models, structural models, and behavioral models.

2.2. System analysis

A system is defined as the organized relationship between any group of components which are linked and working together to achieve a common goal. Today, we live in a world of systems. Our world is a system of natural and man-made factors working together to sustain life. In developing any sort of system, there has to be some sort or plan, organization, and order. The tidier a room the easier it is to find things. In a messy room, items can be hard to locate.

System analysis is defined as the process of identifying problems and organizing the facts and details of a system. System analysis can also be described as the meticulous breakdown of a system into its organized components or parts. It's important to know what works with what, what causes something to work or fail, and what can work independently.

This process illustrate the ins and outs of a system. System analysis can occur in either the developmental stage of a system or it can be conducted on an existing system in which observations are made on the running system for troubleshooting and system improvement purposes. In either case, it serves the same purpose.

We will discuss two special components of system analysis:

- **Unified Modeling Language (UML) Diagram.**
- **Context Model Diagram & Data Flow Diagram (DFD).**

2.2.1. Unified Modeling Language (UML) Diagram:

UML is an acronym that stands for Unified Modeling Language. Simply put, UML is a modern approach to modeling and documenting software. In fact, it's one of the most popular business process modeling techniques. It is based on diagrammatic representations of software components. As the old proverb says: "a picture is worth a thousand words". By using visual representations, we are able to better understand possible flaws or errors in software or business processes.

UML was created as a result of the chaos revolving around software development and documentation. In the 1990s, there were several different ways to represent and document software systems. The need arose for a more unified way to visually represent those systems and as a result, in 1994-1996, the UML was developed by three software engineers working at Rational Software. It was later adopted as the standard in 1997 and has remained the standard ever since, receiving only a few updates.

There are several types of UML diagrams and each one of them serves a different purpose regardless of whether it is being designed before the implementation or after (as part of documentation).

The two broadest categories that encompass all other types are Behavioral UML diagram and Structural UML diagram. As the name suggests, some UML diagrams try to analyze and depict the structure of a system or process, whereas

other describe the behavior of the system, its actors, and its building components.

The different types are broken down as follows:

1. **Behavioral UML Diagram:**
    - **a)** Activity Diagram
    - **b)** Use Case Diagram
    - **c)** Interaction Overview Diagram
    - **d)** Timing Diagram
    - **e)** State Machine Diagram
    - **f)** Communication Diagram
    - **g)** Sequence Diagram
2. **Structural UML Diagram:**
    - **a)** Class Diagram
    - **b)** Object Diagram
    - **c)** Component Diagram
    - **d)** Composite Structure Diagram
    - **e)** Deployment Diagram
    - **f)** Package Diagram
    - **g)** Profile Diagram

2.2.2. Context Model Diagram & Data Flow Diagram (DFD):

2.2.2.1. Context Model:

Context model defines how context data are structured and maintained (It plays a key role in supporting efficient context management).

It aims to produce a formal or semi-formal description of the context information that is present in a context-aware system. In other words, the context is the surrounding element for the system, and a model provides the mathematical interface and a behavioral description of the surrounding environment.

Context models which include use case, context and process diagrams.

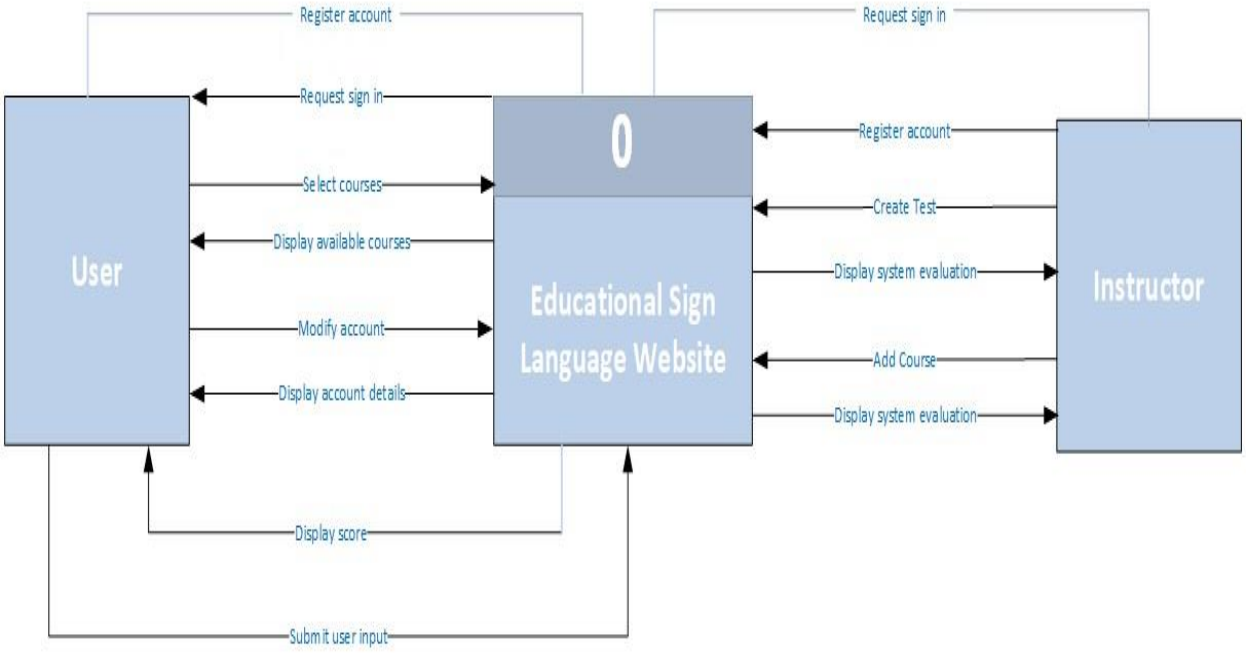


Figure 2.1: Context Diagram for the system

2.2.2.2. Data Flow Diagrams (DFD):

Also known as DFD, Data flow diagrams are used to graphically represent the flow of data in a business information system. DFD describes the

processes that are involved in a system to transfer data from the input to the file storage and reports generation.

Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow.

1. Process:

A process receives input data and produces output with a different content or form. Processes can be as simple as collecting input data and saving in the database, or it can be complex as producing a report containing monthly sales of all retail stores in the northwest region.

For example:

- Apply Payment.
- Calculate Commission.

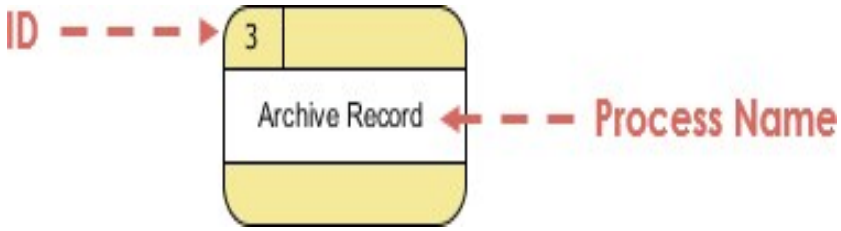


Figure 2.2: DFD Process shape

2. Data Flow:

A data-flow is a path for data to move from one part of the information system to another. A data-flow may represent a single data element such the Customer ID or it can represent a set of data element (or a data structure).

For example:

- Customer info (LastName, FirstName, SS#, Tel #, etc.).
- Order info (OrderId, Item#, OrderDate, CustomerID, etc.).

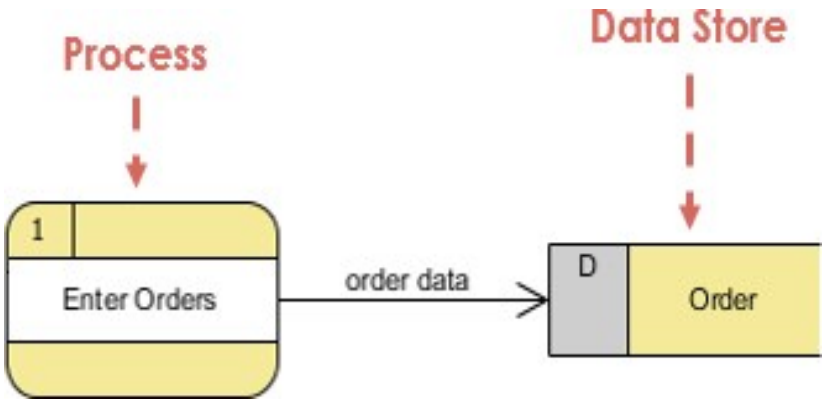


Figure 2.3: DFD Data Flow shape.

3. Data Store:

A data store or data repository is used in a data-flow diagram to represent a situation when the system must retain data because one or more processes need to use the stored data at a later time.

For example:

- Customer Information DB.
- Supply Request DB.

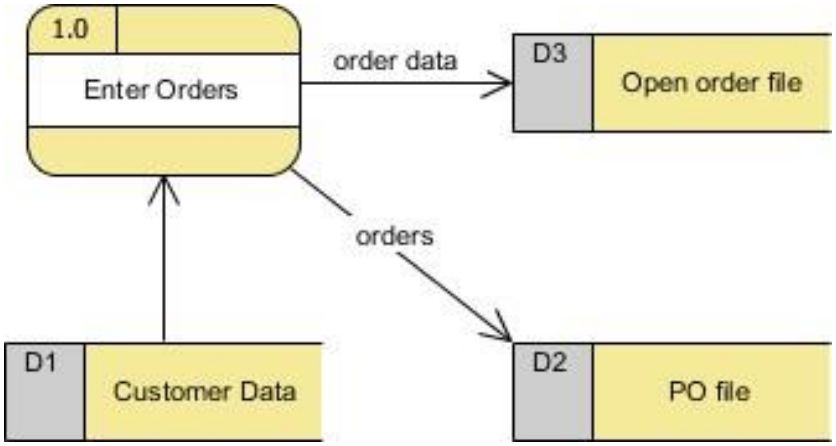


Figure 2.4: DFD Data Store shape

4. External Entity:

An external entity is a person, department, outside organization, or other information system that provides data to the system or receives outputs from the system. External entities are components outside of the boundaries of the information systems. They represent how the information system interacts with the outside world.

For example:

- A customer submitting an order and then receive a bill from the system.
- A vendor issue an invoice.

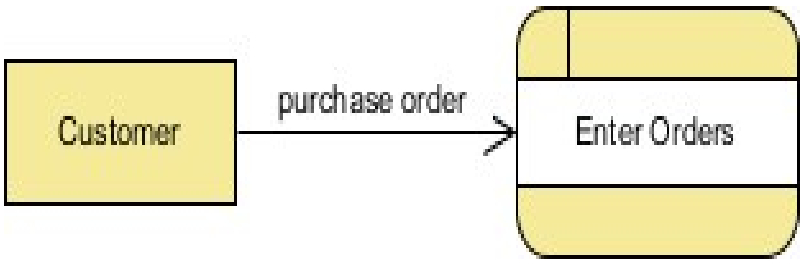


Figure 2.5: DFD External Entity shape.

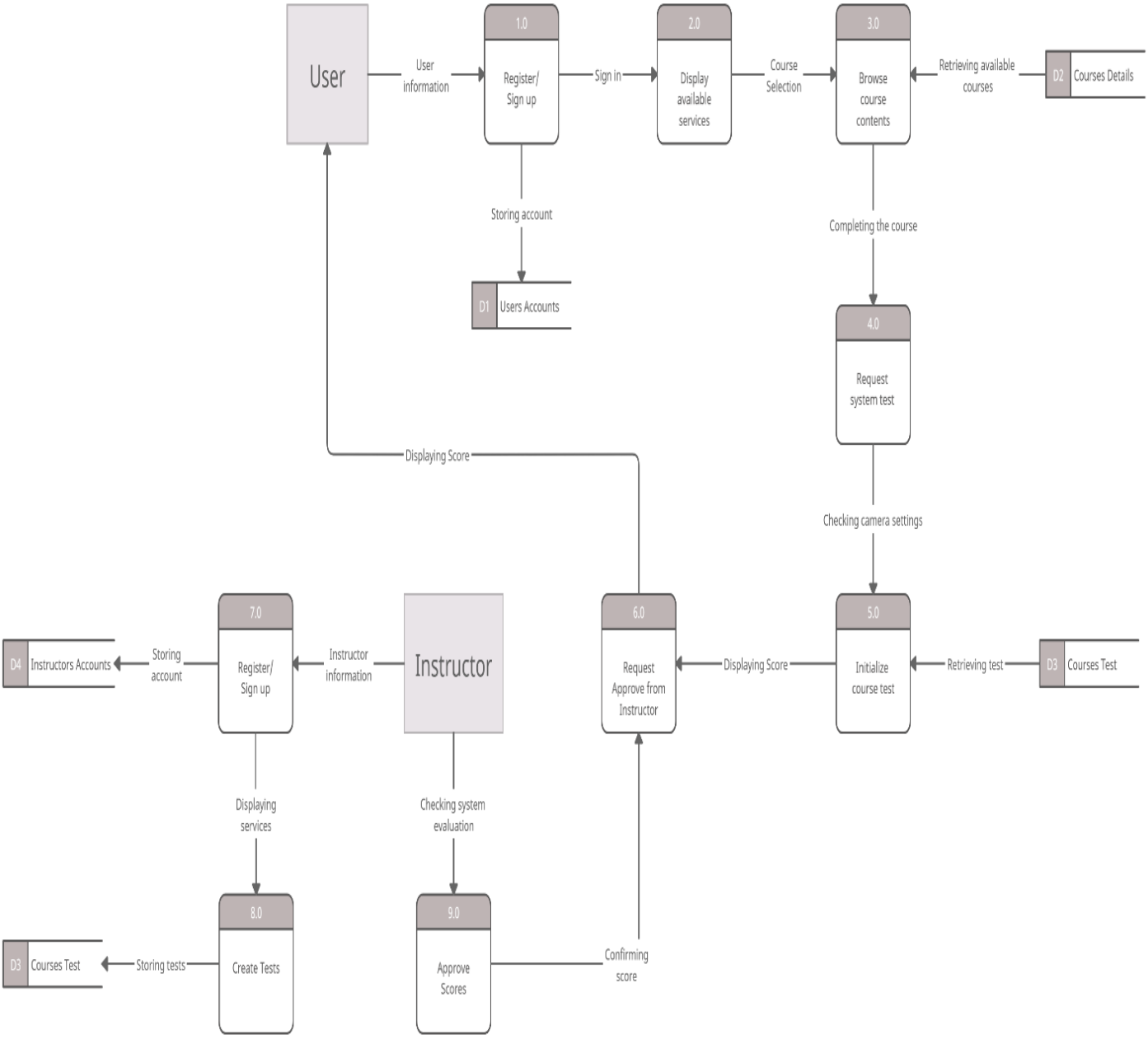


Figure 2.6: Data Flow Diagram Level 0 for the system

2.2.3. Use Case Diagram:

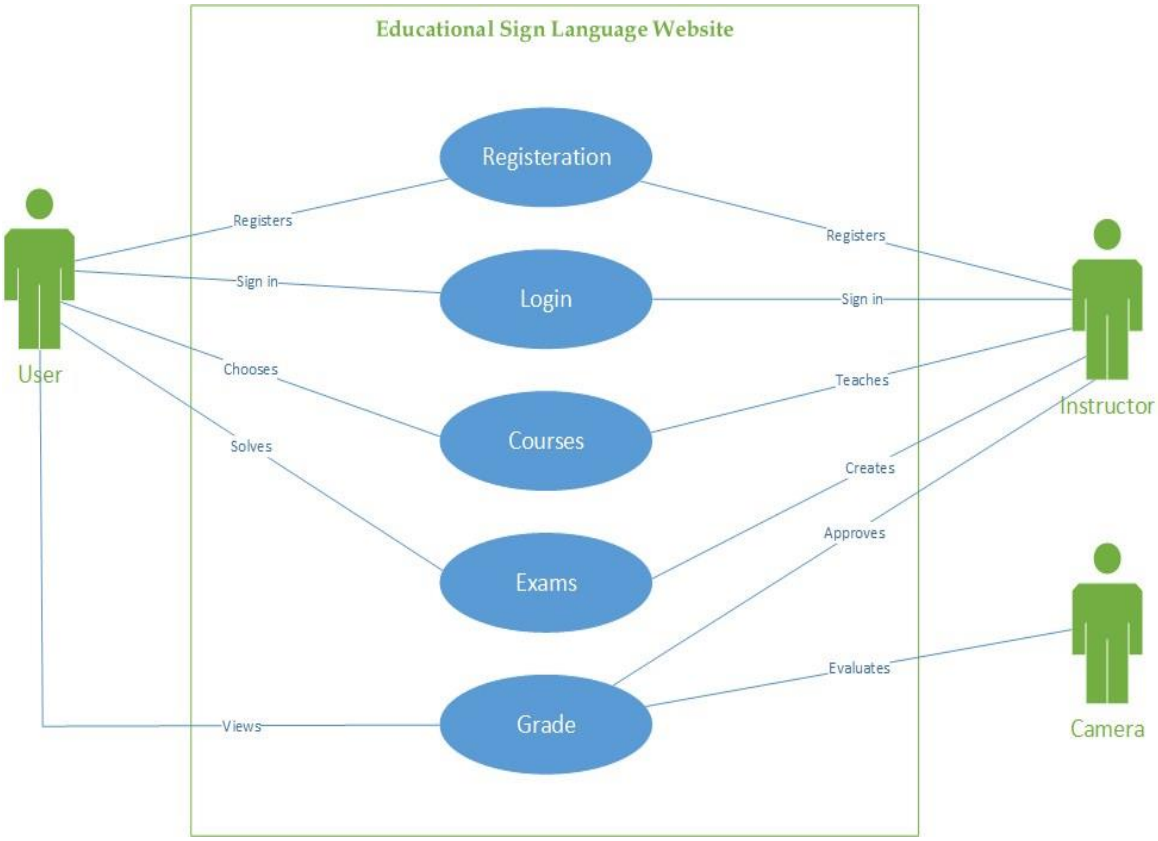


Figure 2.7: UML Use Case Diagram for the system

2.2.4. Sequence Diagram:

2.2.4.1: Registration:

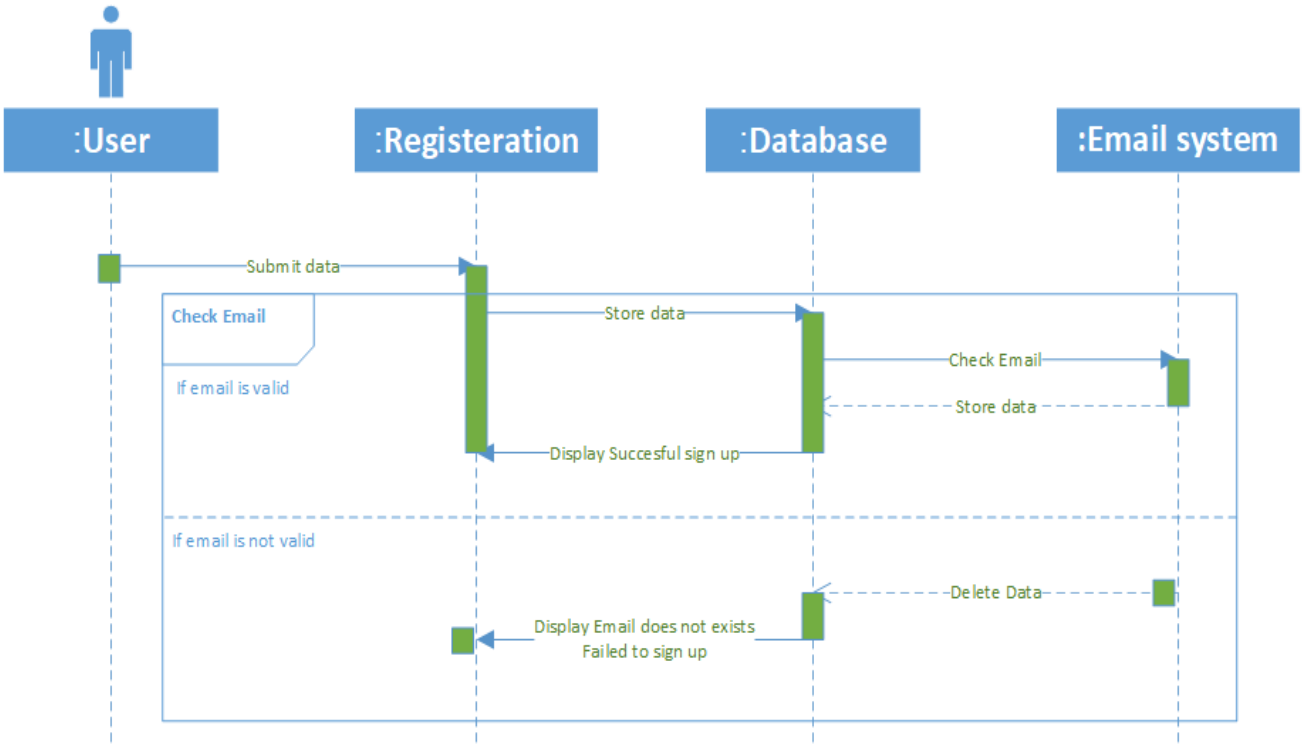
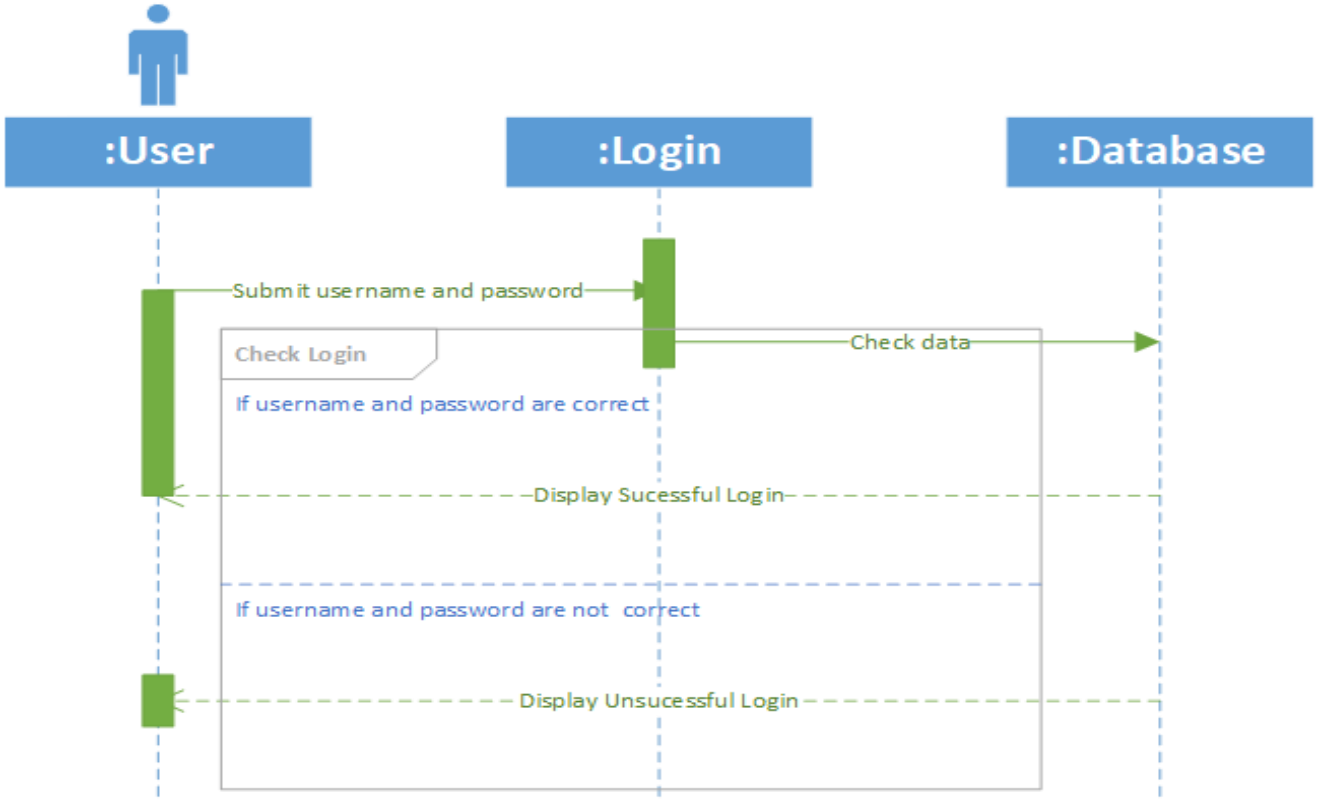


Figure 2.8: UML Sequence Diagram for registration process

2.2.4.2. Login:



Figurer 2.9: UML Sequence Diagram for login process

2.2.4.3: Camera Test:

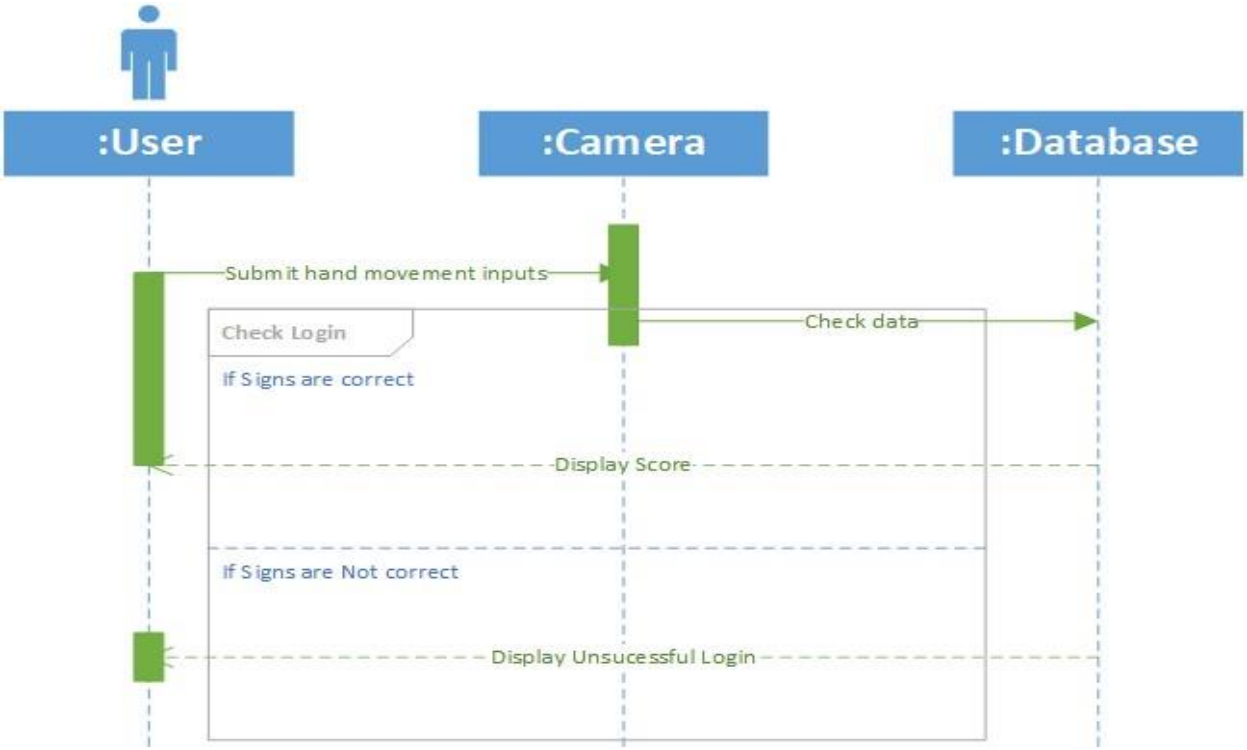


Figure 2.10: UML Sequence Diagram for Test process

2.2.4.4: Courses:

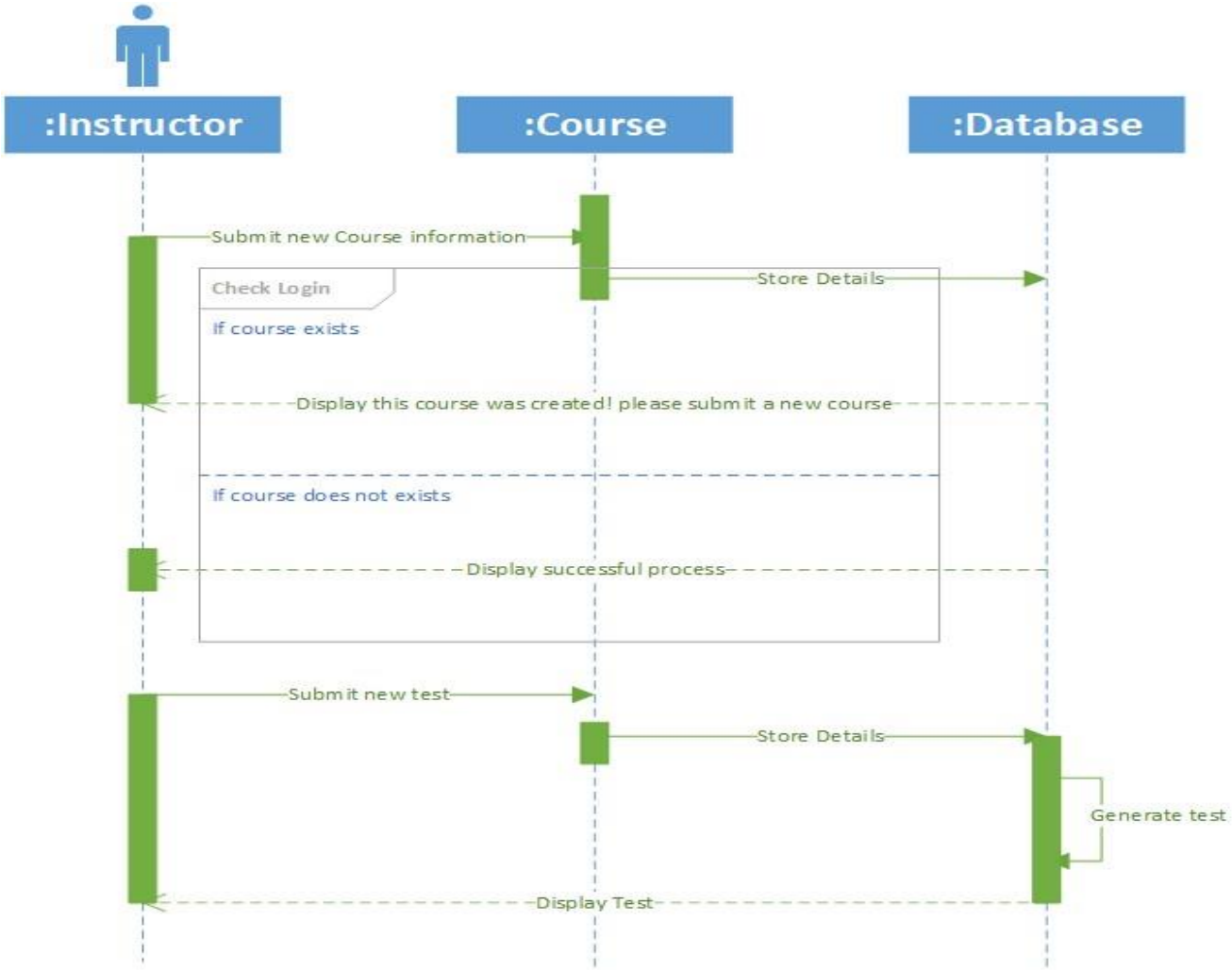


Figure 2.11: UML Sequence Diagram for Courses process

2.2.5. Class Diagram:

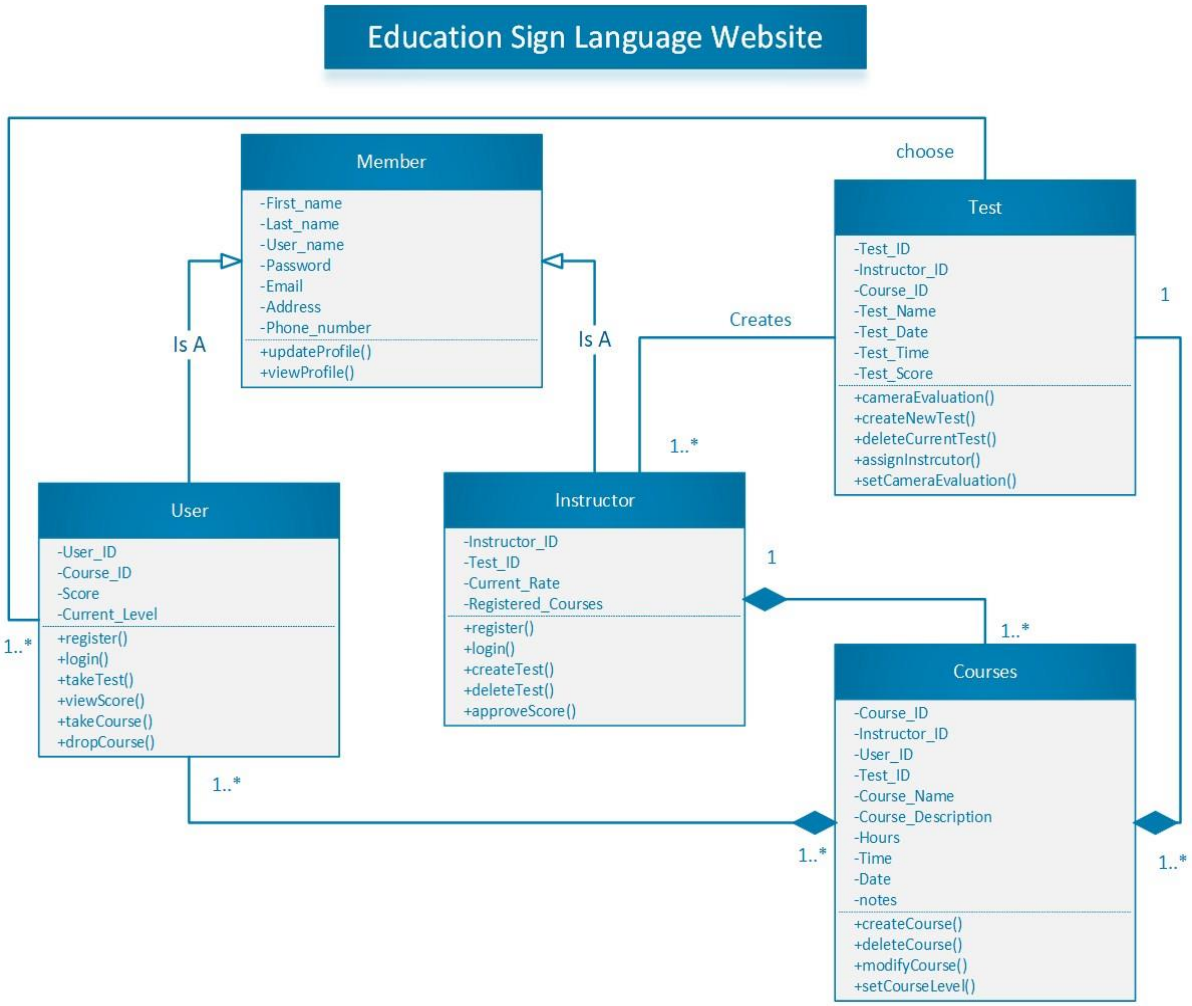


Figure 2.12: UML Class Diagram for the system

2.2.6. Process Diagram (Activity Diagram):

2.2.6.1: User Processes:

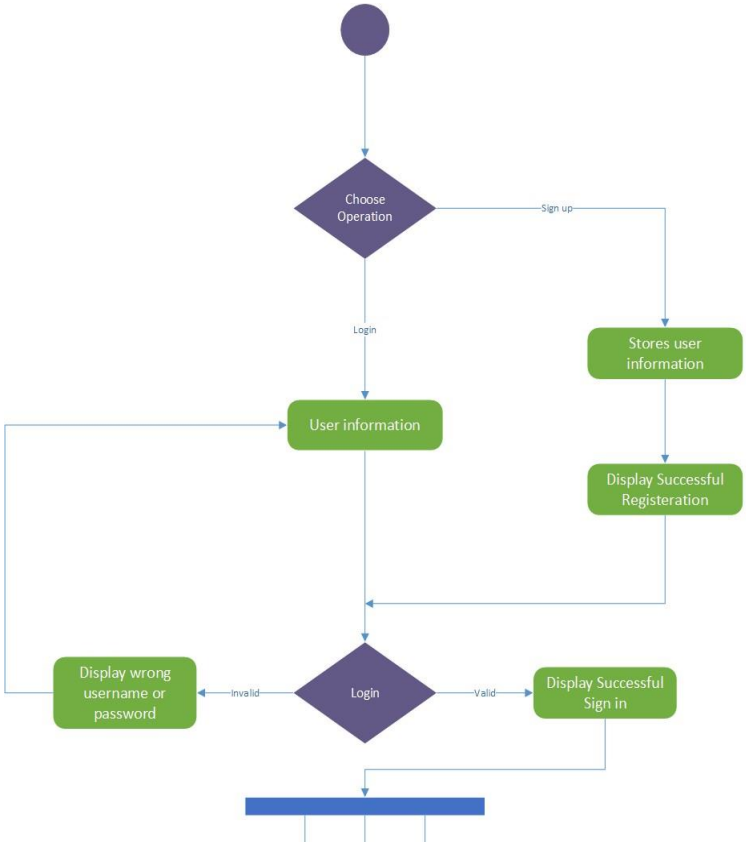


Figure 2.13-A: UML Activity/Process Diagram for the user

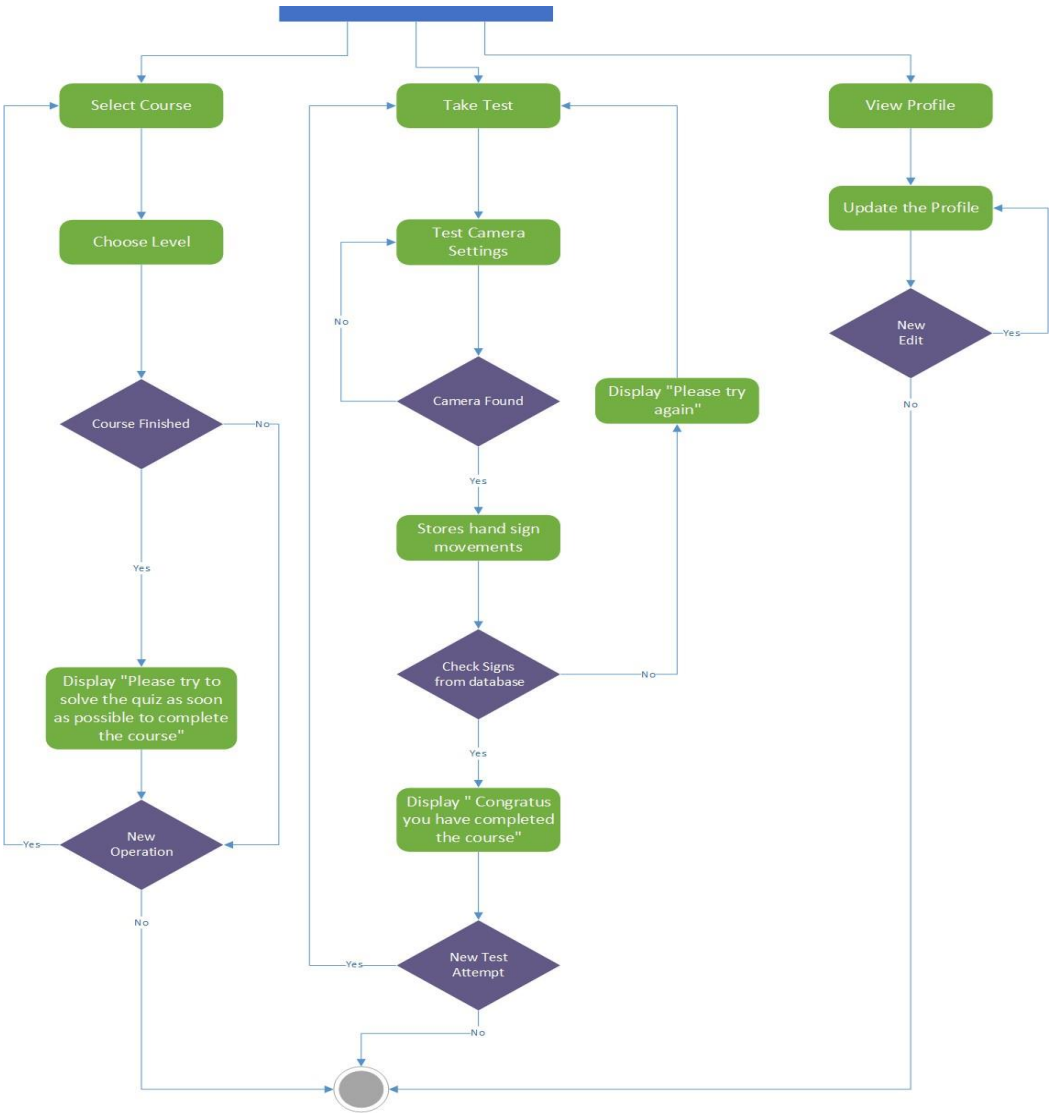


Figure 2.13-B: UML Activity/Process Diagram for the user

2.2.6.2: Instructor Processes:

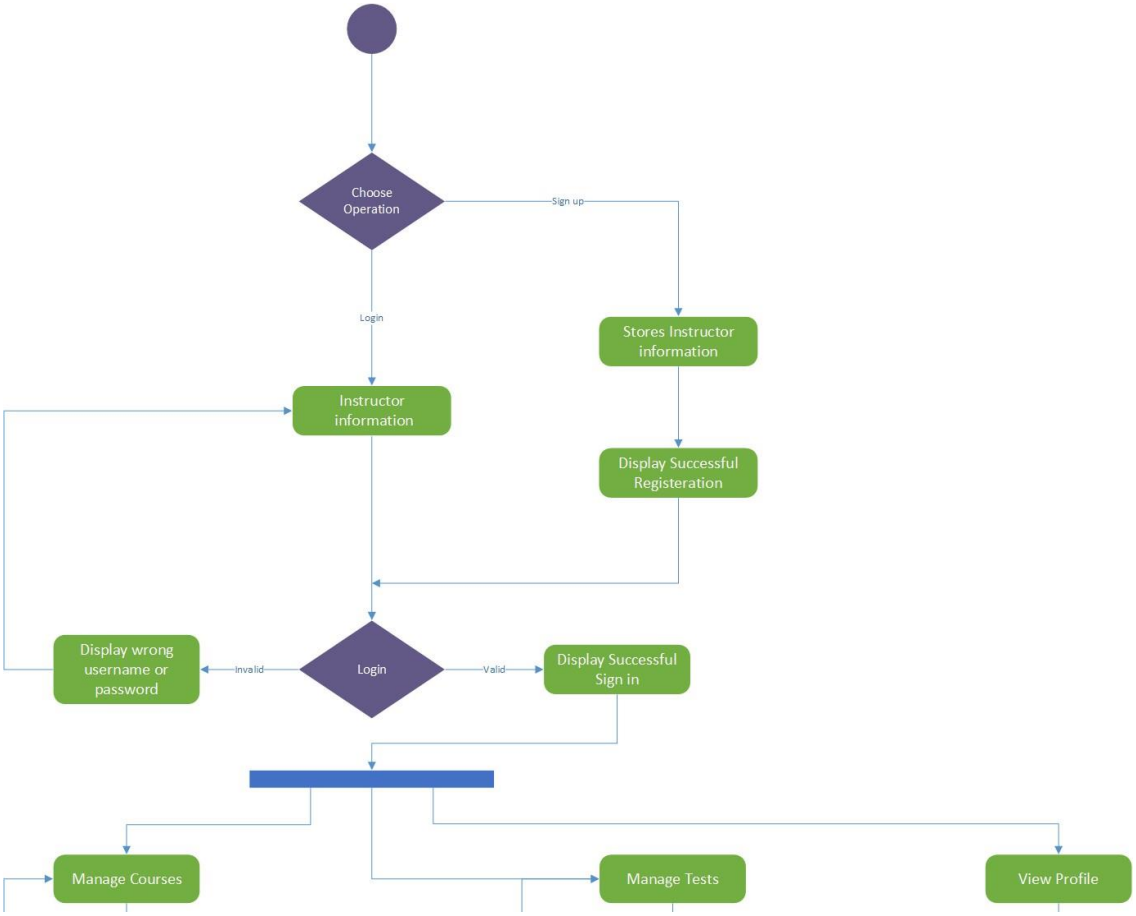
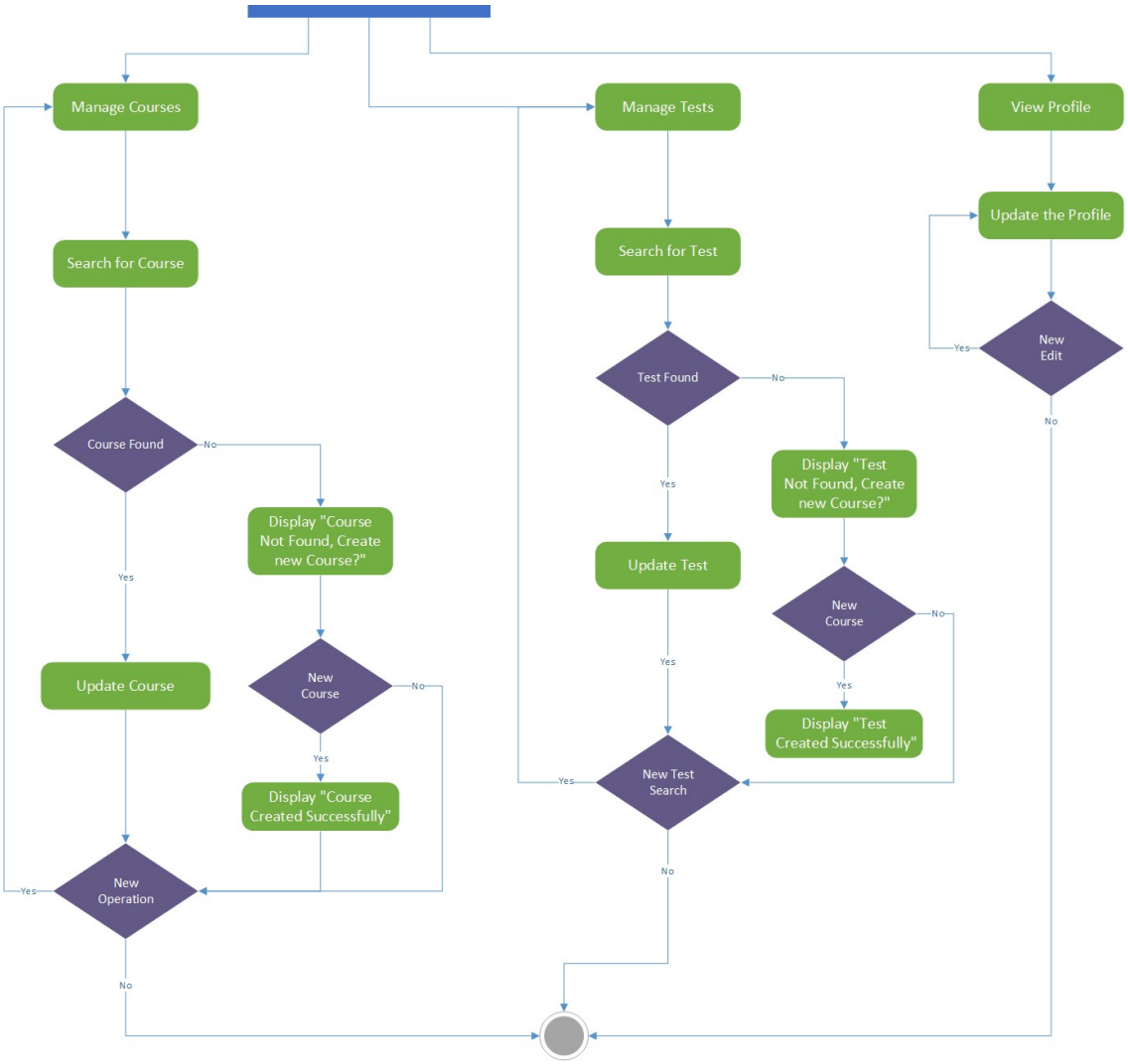


Figure 2.14-A: UML Activity/Process Diagram for the Instructor.



+Figure 2.14-B: UML Activity/Process Diagram for the Instructor.

2.2.7. State Chart Diagrams:

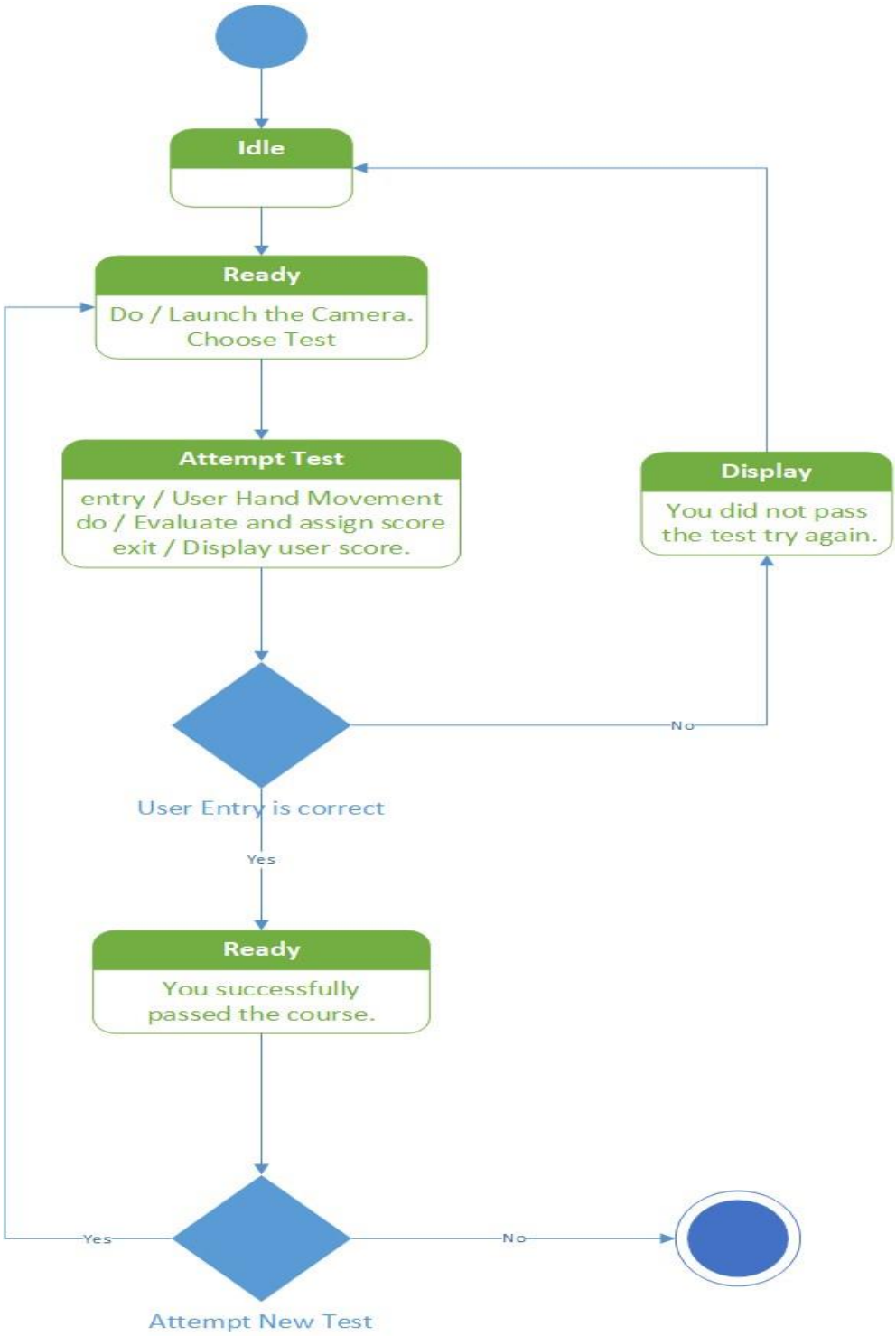


Figure 2.15: UML State Chart Diagram for the test process.

2.2.8. Entity Relationship Diagram (ERD):

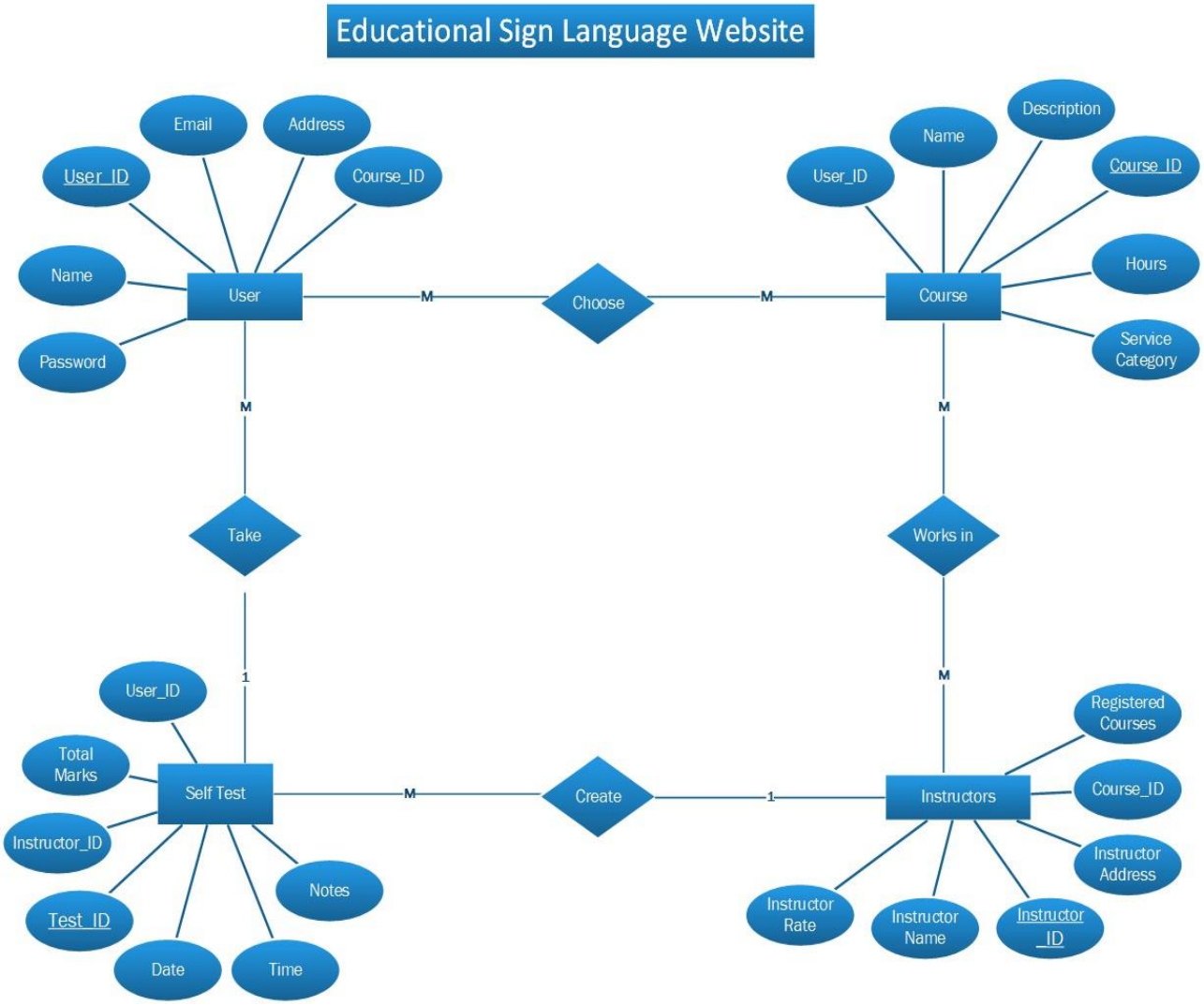


Figure 2.16: Entity Relationship Diagram for the system.

Chapter 3: System implementation

3.1. The Enhanced Proposed System Architecture

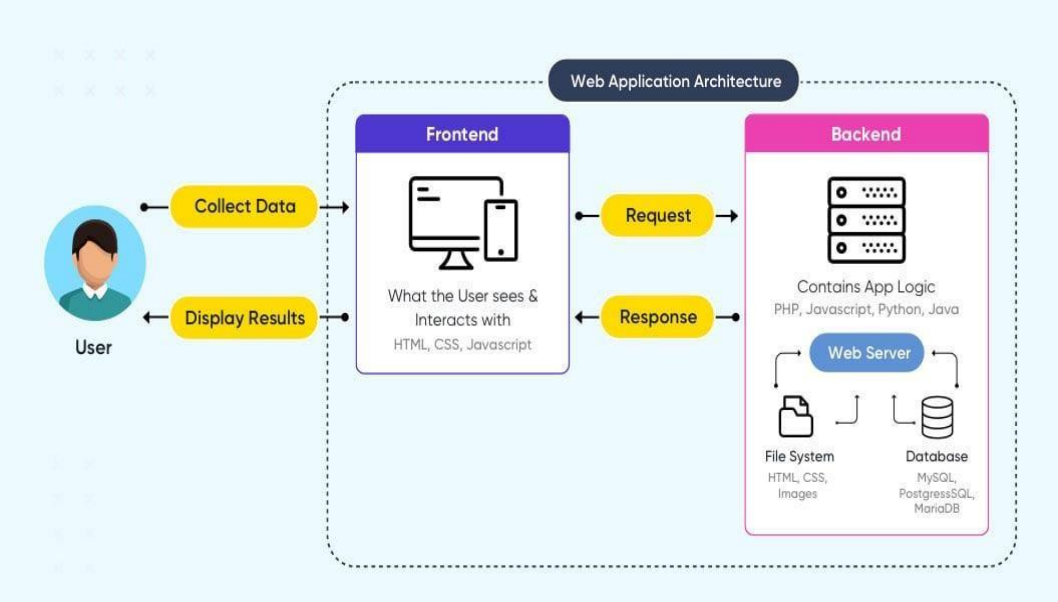


Figure 3.1: System Architecture of the system

Today's consumers bring high expectations to their online and mobile experiences, influenced by how useful, usable, desirable, accessible, credible, findable and valuable they find the interactions, as expressed by the user experience honeycomb.

While users cannot see the web app architecture, decisions made at the architecture level can impact the ultimate experience the user receive. In a web application, you can think of two separate programs (buckets of code) that run in parallel as follows:

1- **Client-side code:** The code in the front-end (HTML, CSS, JavaScript) that responds to user inputs and creates the visual representation (user interface or UI).

2- **Back-end code:** The back-end or server-side code has two jobs: one, to respond to HTTP requests and return responses to the client and

two, to store different types of data. Server-side code can be one of a myriad of languages including C#, Java, Python, Ruby, Node.js, PHP, etc.

The web app architecture is made up of several application components (or layers) and their interactions, choices that have a direct impact on the efficiency of the overall web app as well as its security, user experience, and ability to scale.

A new service is added which is a camera that detects the user hand during a quiz to determine if the user have passed the course or not to go to the next level of the course. This process is done by searching in the database of the saved images for sign languages and also several datasets are involved to increase the robustness of detection process.

3.2. List of used algorithms

Search algorithms help determine the ranking of a web page at the end of the search when the results are listed. Each search engine uses a specific set of rules to help determine if a web page is real or spam and if the content and data within the page is going to be of interest to the user. The results of this process ultimately determine a site's ranking on the search engine results page. While each set of rules and algorithm formulas vary, search engines use relevancy, individual factors and off-page factors to determine page ranking in search results.

A binary search algorithm, unlike linear search algorithms, exploits the ordering of a list. This algorithm is the best choice when similarity has terms occurring in order of increasing size. The algorithm starts in the middle of the list.

If the target is lower than the middle point, then it eliminates the upper half of the list; if the target is higher than the middle point, then it cuts out the lower half of the list. For larger databases, binary search algorithms will produce much faster results than linear search algorithms. For the camera detection, we will be using Convolution Neural Network (CNN) which is a deep learning neural network designed for processing structured arrays of data such as images.

Convolutional neural networks are widely used in computer vision and have become the state of the art for many visual applications such as image classification and have also found success in natural language processing for text classification.

Convolutional neural networks are very good at picking up on patterns in the input image, such as lines, gradients, circles, or even eyes and faces. It is this property that makes convolutional neural networks so powerful for computer vision. Unlike earlier computer vision algorithms, convolutional neural networks can operate directly on a raw image and do not need any preprocessing.

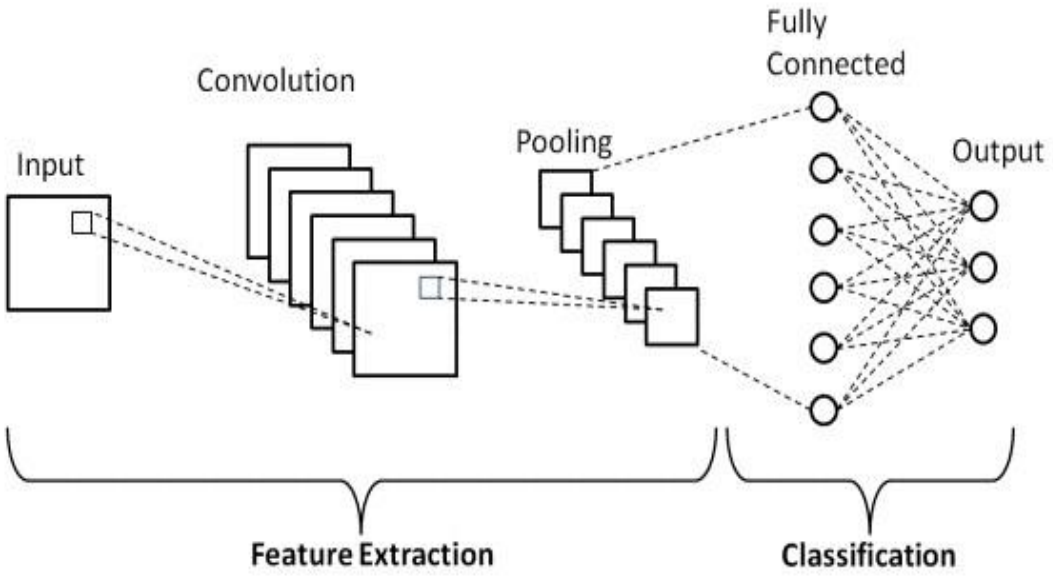


Figure 3.2: Convolution Neural Network Scheme.

There are three types of layers that make up the CNN which are the convolutional layers, pooling layers, and fully-connected (FC) layers. When these layers are stacked, a CNN architecture will be formed.

In addition to these three layers, there are two more important parameters which are the dropout layer and the activation function which are defined below.

1. **Convolutional Layer:**

   This layer is the first layer that is used to extract the various features from the input images. In this layer, the mathematical operation of convolution is performed between the input image and a filter of a particular size MxM.

   By sliding the filter over the input image, the dot product is taken between the filter and the parts of the input image with respect to the size of the filter (MxM).

2. Pooling Layer:

In most cases, a Convolutional Layer is followed by a Pooling Layer. The primary aim of this layer is to decrease the size of the convolved feature map to reduce the computational costs.

This is performed by decreasing the connections between layers and independently operates on each feature map. Depending upon the method used, there are several types of Pooling operations. It basically summarizes the features generated by a convolution layer.

3. Fully Connected Layer

The Fully Connected (FC) layer consists of the weights and biases along with the neurons and is used to connect the neurons between two different layers. These layers are usually placed before the output layer and form the last few layers of a CNN architecture.

In this, the input image from the previous layers are flattened and fed to the FC layer. The flattened vector then undergoes few more FC layers where the mathematical functions operations usually take place.

In this stage, the classification process begins to take place. The reason two layers are connected is that two fully connected layers will perform better than a single connected layer. These layers in CNN reduce the human supervision .

3.3. Methodologies

Figure 3.3: Agile methodology illustration for the system

There are different types of methodologies that can be used to create a system but not all of these methodologies are suitable for our project. The Scrum methodology is one of the best methodologies that can fit well with our project since the idea of the project is not about the sequence of execution with project phases that do not advance until a phase receives final approval.

Scrum is a framework for agile project management that uses fixed length iterations of work, called sprints. There are four ceremonies that bring structure to each sprint. It all starts with the backlog, or body of work that needs to be done.

In scrum, there are two backlogs: one is the product backlog (owned by the product owner) which is a prioritized list of features, and the other is the sprint backlog which is filled by taking issues from the top of the product backlog until the capacity for the next sprint is reached.

Typically, there's a scrum master, or champion of the scrum method for the team; the product owner, who's the voice of the product; and the scrum team, who are often cross-functional team members in charge of getting all the tasks done.

Agile is an iterative approach to project management and software development that helps teams deliver value to their customers faster and with fewer headaches. Instead of betting everything on a "big bang" launch, an agile team delivers work in small, but consumable, increments. Requirements, plans, and results are evaluated continuously so teams have a natural mechanism for responding to change quickly.

Whereas the traditional "waterfall" approach has one discipline contribute to the project, then "throw it over the wall" to the next contributor, agile calls for collaborative cross-functional teams. Open communication, collaboration, adaptation, and trust amongst team members are at the heart of agile.

3.4: Implemented Algorithms:

3.4.1. KNN Classifier:

```
const createKNNClassifier = async () => {
    console.log('Loading KNN Classifier');
    return await knnClassifier.create();
};
const createMobileNetModel = async () => {
    console.log('Loading Mobilenet Model');
    return await mobilenet.load();
};
const createWebcamInput = async () => {
    console.log('Loading Webcam Input');
    const webcamElement = await document.getElementById('webcam');
    return await tf.data.webcam(webcamElement);
};

const mobilenetModel = await createMobileNetModel();
const knnClassifierModel = await createKNNClassifier();
const webcamInput = await createWebcamInput();
var preloader = document.getElementById("loading");
```

Figure 3.4: KNN Algorithm

3.4.2: MobileNet DNN:

```
  // Extract the already learned features from MobileNet
  featureExtractor = ml5.featureExtractor('MobileNet', modelReady);
  const knnClassifier = ml5.KNNClassifier();


  // Create a new classifier using those features and give the video we want to use
  const options = { numLabels: 21 };
  classifier = featureExtractor.classification(video, options);
  // Set up the UI buttons
  setupButtons();
}

// A function to be called when the model has been loaded
async  function modelReady() {
  select('#modelStatus').html('MobileNet Loaded!');
  // If you want to load a pre-trained model at the start

  await classifier.load('model.json', function() {
     select('#modelStatus').html('Custom Model Loaded!');
   });
}

// Classify the current frame.
function classify() {
  classifier.classify(gotResults);
}
```

Figure 3.5-A: MobileNet-Dnn Algorithm

```
const imageClassificationWithTransferLearningOnWebcam = async () => {
    console.log("Machine Learning on the web is ready");
    while (true) {
        if (knnClassifierModel.getNumClasses() > 0) {
            const img = await webcamInput.capture();

            // Get the activation from mobilenet from the webcam.
            const activation = mobilenetModel.infer(img, 'conv_preds');
            // Get the most likely class and confidences from the classifier module.
            const result = await knnClassifierModel.predictClass(activation);

            //console.log(classes[result.label - 1].name)
            text = classes[result.label - 1].name
            console.log(text)
            predictions.innerHTML = classes[result.label - 1].name
            console.log(result.confidences[result.label])

            confidence.innerHTML = Math.floor(result.confidences[result.label] * 100)

            // Dispose the tensor to release the memory.
            img.dispose();
        }
        await tf.nextFrame();
    }
};
```

Figure 3.5-B: MobileNet-Dnn Algorithm

3.4.3: Webcam:

```
const addDatasetClass = async (classId) => {

    // Capture an image from the web camera.
    const img = await webcamInput.capture();

    // Get the intermediate activation of MobileNet 'conv_preds' and pass that
    // to the KNN classifier.
    const activation = mobilenetModel.infer(img, 'conv_preds');

    // Pass the intermediate activation to the classifier.
    knnClassifierModel.addExample(activation, classId);

    let classIndex = classes.findIndex(el => el.id === classId)
    currentCount = classes[classIndex].count
    currentCount += 1
    classes[classIndex].count = currentCount

    var temp_id = 'images-' + classId.toString()
    document.getElementById(temp_id).innerHTML = currentCount;

    // Dispose the tensor to release the memory.
    img.dispose();
};
```

Figure 3.6: WebCam

3.5. Implemented Web

3.5.1. Home Page:

Welcome to our Home Page where you can look and investigate our website. From here you can login, registration or even take a look at courses.

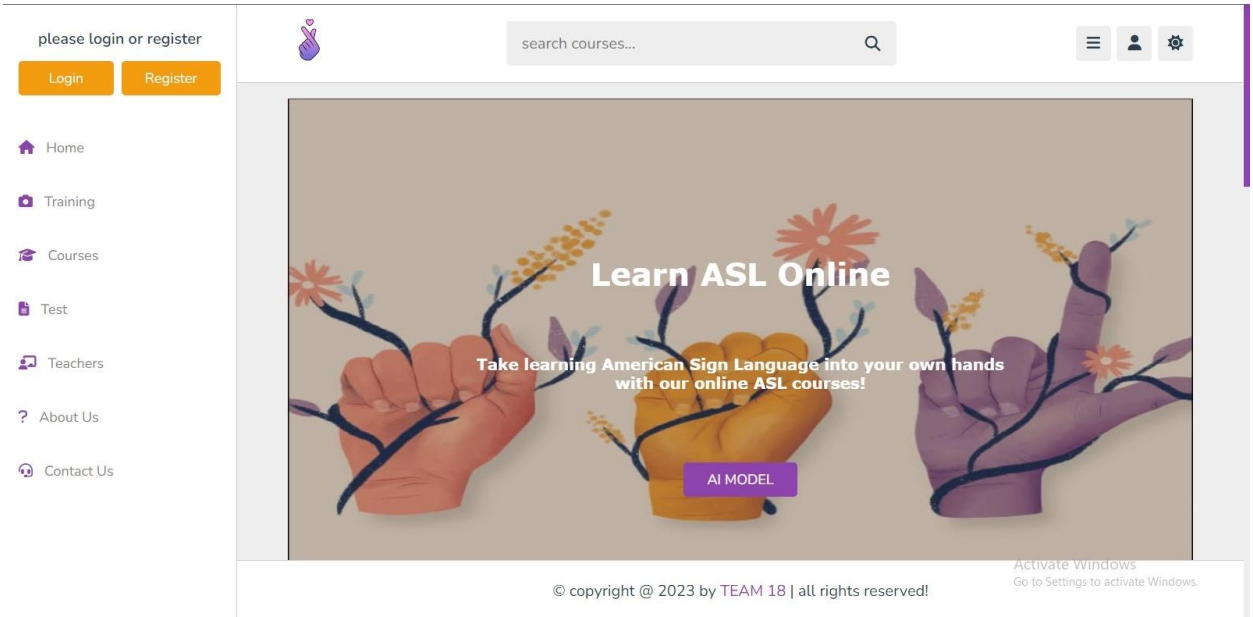


Figure 3.7: Home Page

3.5.2. Login Page:

Here we start login if the account already exists, and if not you can move on to registration page surly by click on register now.

It's the beginning of join to deaf and hard hearing culture for learning more and more about them to make easy communication for them.

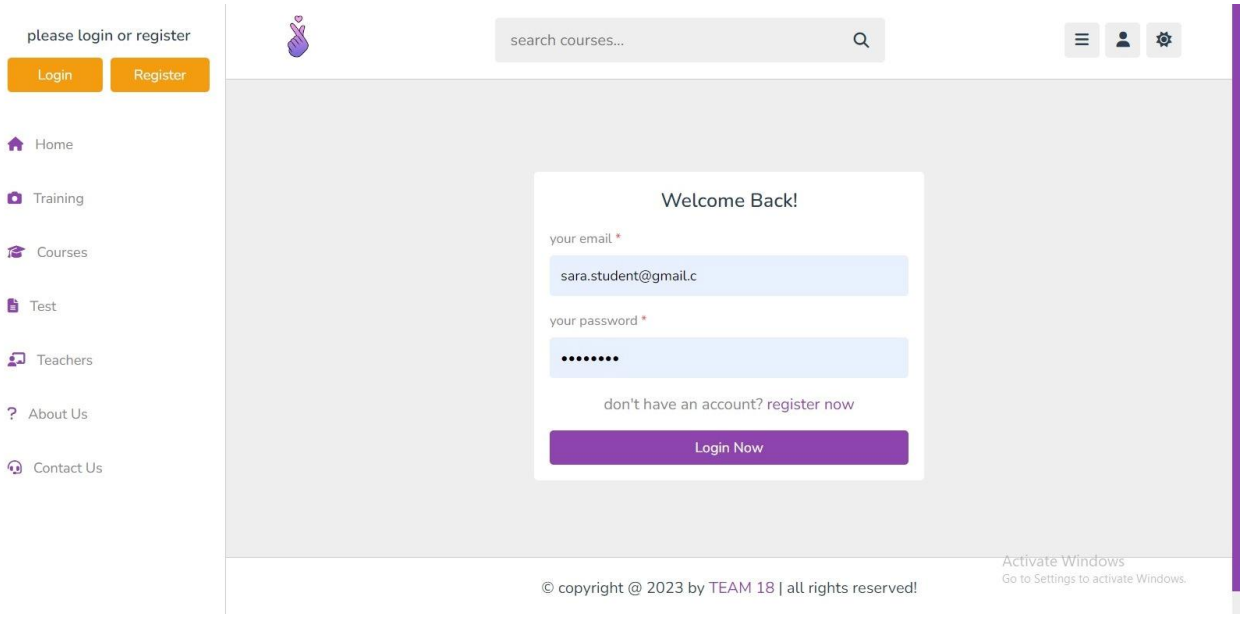


Figure 3.8: Login Page

3.5.3. Register Page:

If you don't have an account, u can easily register from here.

You need to write your name, password, your email, and finally choose your picture to be distinct from other users.

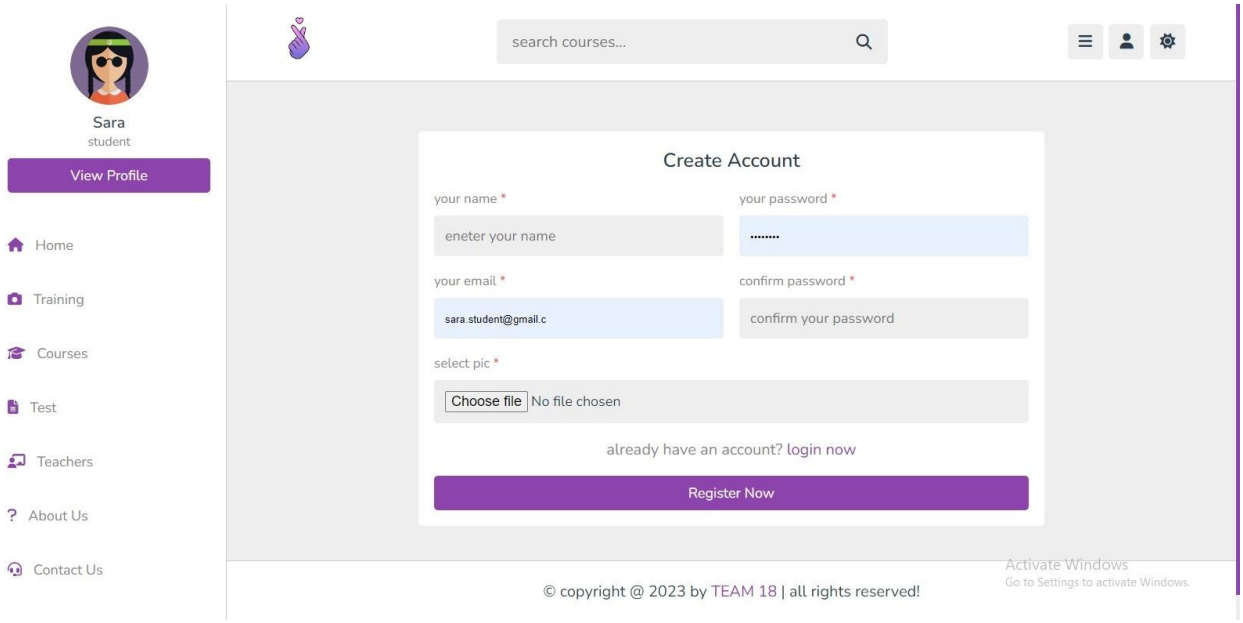


Figure 3.9: Registration page

3.5.4. Profile Page:

Registration or login successfully. Now you can see your profile and your playlists, video likes or even your comments, also you can update profile as you like.

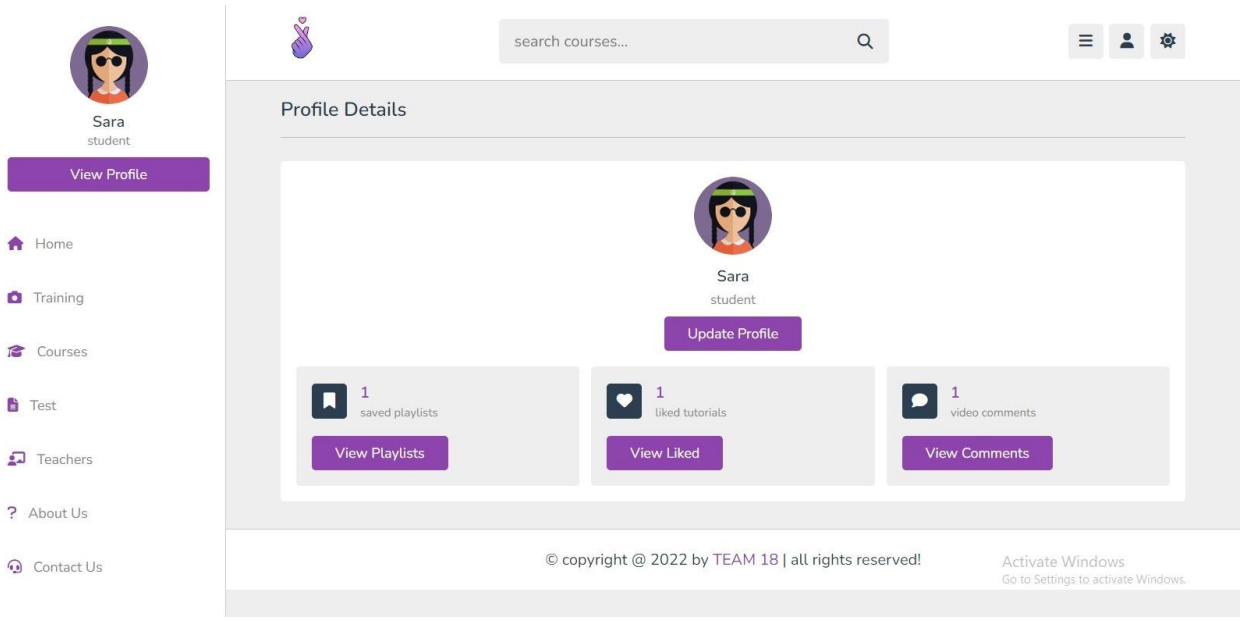


Figure 3.10: Profile Page

3.5.5. Courses Page:

We didn't forget about dark mode, all for the safety of your eyes.

In this page you can search and find more and more playlist, videos or even teachers you liked.

All kind of courses you can find it here from kids to high levels.

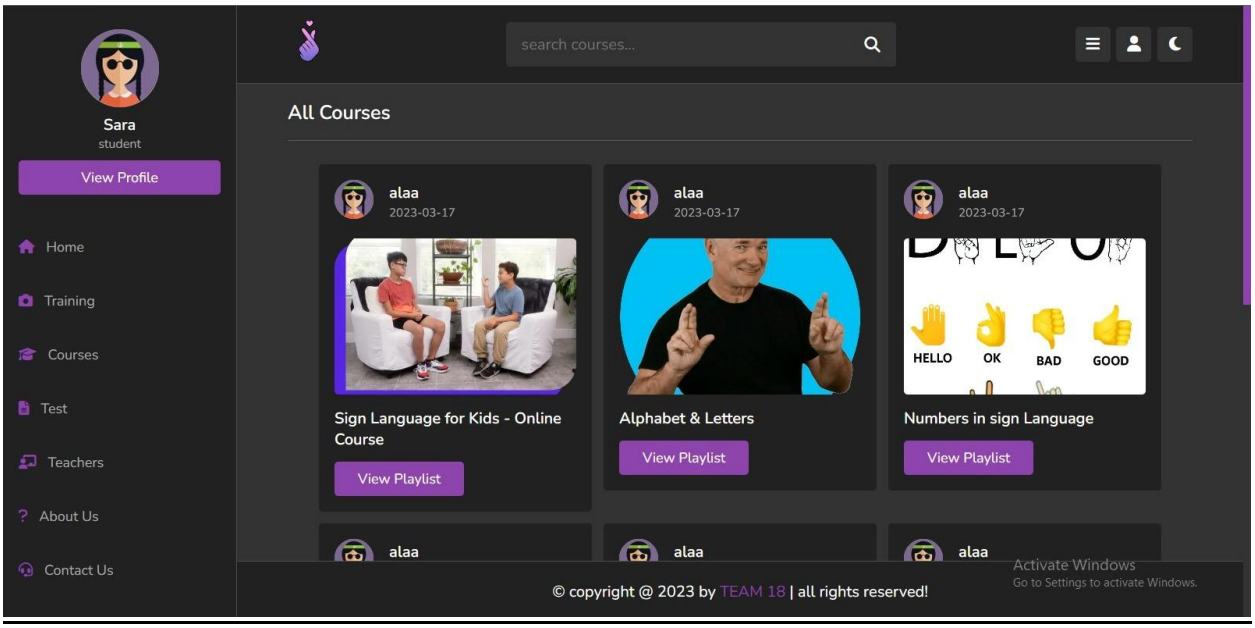


Figure 3.11: Courses Page

3.5.6. Train Page:

From here you can train on letters and many words. and from this box, you can see what's the correct movement or to be more specific, the correct sign you should do .

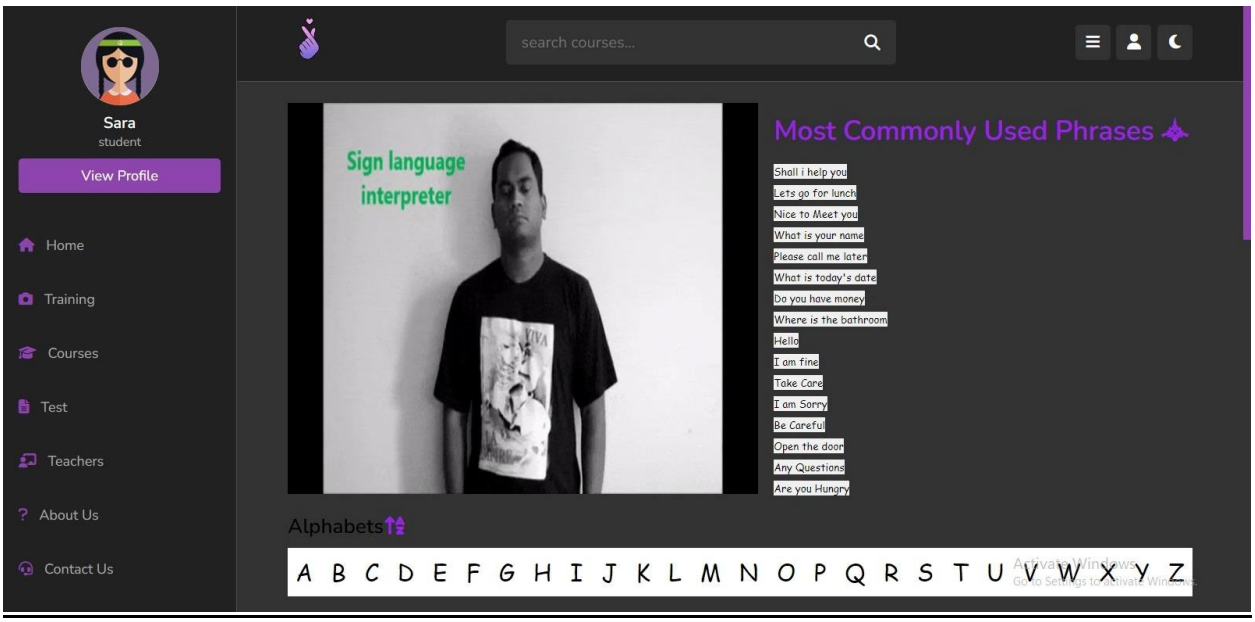


Figure 3.12: Training Page

3.5.7. Test Page:

Here is my favorite page. After the end from training, you can test you skills.

This box first will show you word for example: "LOVE", you will do the same as this box below, or the left of you as user. It will show you the accuracy of your sign, you will not be able jump to the next level if you couldn't end the current level. but don't worry about that, I know you can do it.

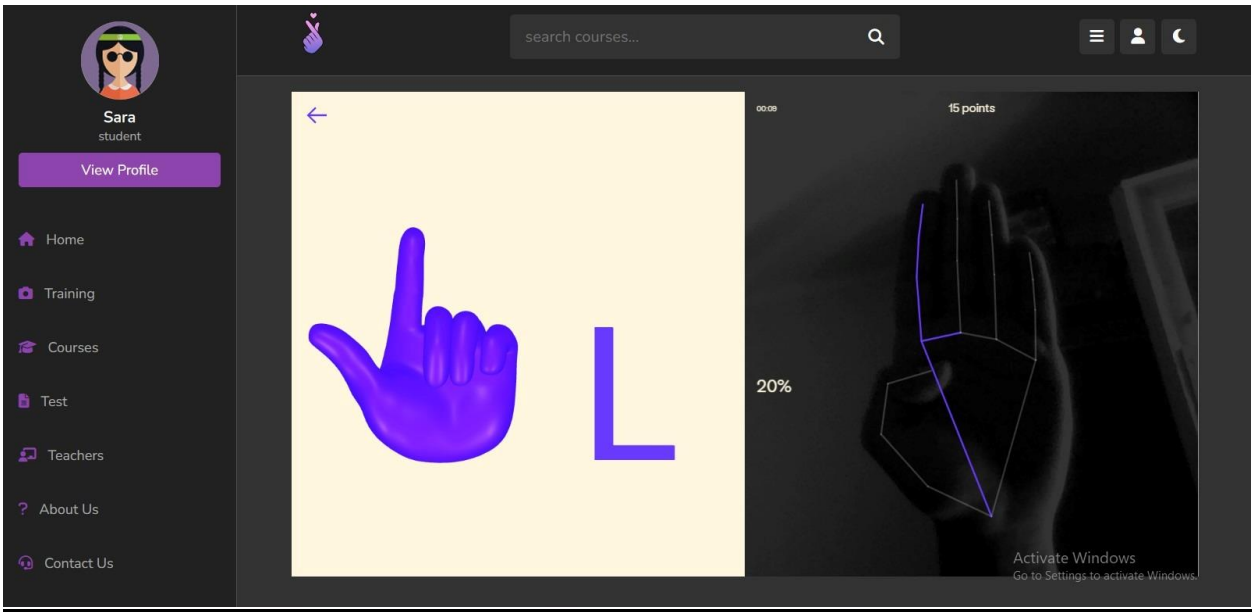


Figure 3.13: Test Page

3.5.8. Contact Page:

This isn't the end you now, you can contact us as you like if there are any issue, just let us know.

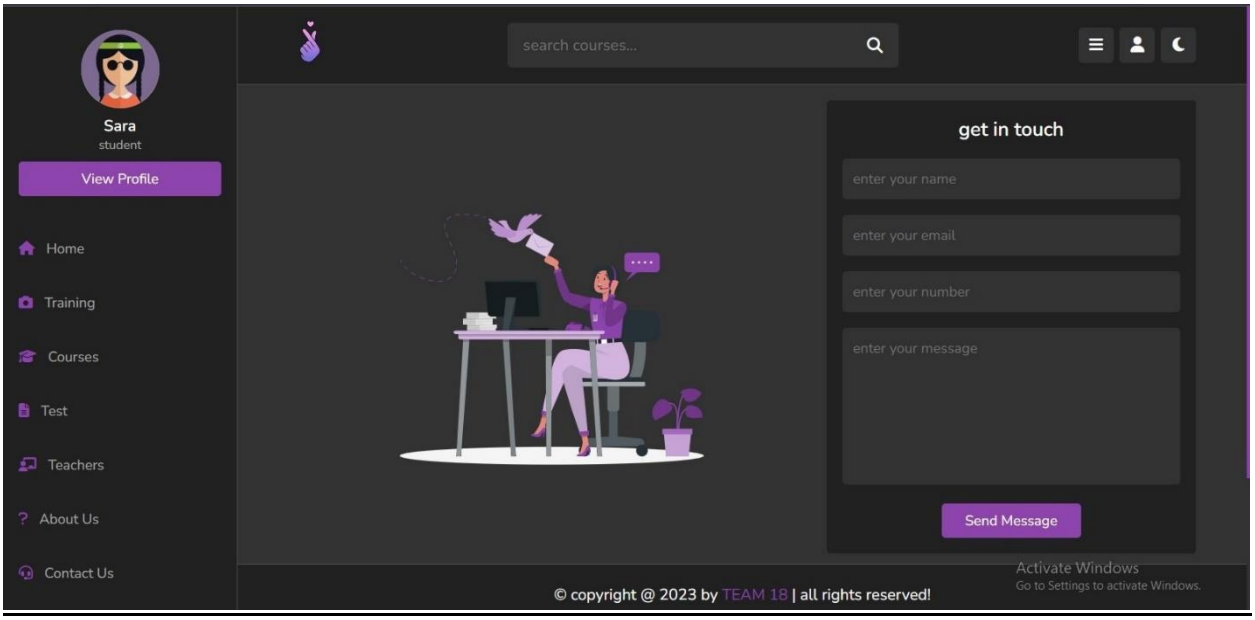


Figure 3.14: Contact-us Page

Conclusion/Discussion

The ISL programe so far, has been very productive over a very short period of time. Within two-and-a-half years, more than 250 hearing people received training in ISL at the basic and/or advanced level. The system provides an interface that can easily communicate with deaf people by Sign Language Recognition. The system is not only can apply in family environment, but also can apply in public. For the Social use these system is very helpful for deaf and dumb people.

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APPENDICES2

Appendix A: Surveys

Appendix B: Code used for development

Appendix C: Algorithm used

Appendix D: sample report

Or any other resources you wish to add, such as figures, details, data, feedback,,.etc.

تعتبر الإعاقة السمعية من الظواهر المألوفة على مر العصور ، ولا يكاد يخلو منها مجتمع ، فهذه الظاهرة هي

موضوع يجمع بين اهتمامات العديد من مجالات العلم والمعرفة ، مثل علم النفس والتعليم والطب والمجتمع ، وذلك لتعدد الهيئات العملية التي ساهمت في تفسير هذه الظاهرة واختلاف الإعاقة السمعية لدى الطفل إما أنه أصم أو ضعف السمع.

يواجه العديد من الصم والبكم صعوبة في التواصل ، ولأن هذه الفئة تحتاج إلى أن يتعلم الجميع لغتهم الخاصة ، سنحاول حل هذه المشكلة وإنشاء موقع يهدف أولاً إلى قياس المستوى الانطباعي للأفراد عند التعرف على لغة الإشارة أيضًا. كاختبارات ودورات متخصصة في هذا المجال