**CHAPTER 7**

**SYSTEM DESIGN**

* **Class Diagram**
* **Use Case Diagram**
* **Sequence Diagram**
* **Activity Diagram**
* **Data Flow Diagram**

1. **CLASS DIAGRAM**

The **Class Diagram** represents the static structure of the system, illustrating the relationships between different objects within the application. It highlights the attributes, operations, and associations among different classes involved in the project. For the SignSpeak project, the Class Diagram models essential components like the Camera, Image Processing, GUI, and ML Model, detailing how they interact to recognize sign language gestures and convert them to text. Each class has a distinct role in capturing, processing, and displaying sign language signs.

|  |  |
| --- | --- |
| A grey and white box with black text  Description automatically generated | Class |
| A black background with a black square  Description automatically generated with medium confidence | Generalization |

Table 7.1.1 Class diagram symbols

A black screen with white text

Description automatically generated

Fig. No. 7.1.1 Class diagram

1. **Use Case Diagram**

The Use Case Diagram shows the interaction between users and the system. It identifies all the possible actions a user can perform and how the system responds to each action. In SignSpeak, users interact with the system by starting the camera, processing the sign images, viewing the result (converted text), and learning the sign images. The Use Case Diagram demonstrates the system's functionality from a user’s perspective, highlighting features such as sign language recognition, feedback, and learning modes.

|  |  |
| --- | --- |
| A black line drawing of a person  Description automatically generated | Actor |
| A white oval with black text  Description automatically generated | Use-case |
| A white rectangular object with black text  Description automatically generated | System |

Fig. No. 7.2.1 Use-case diagram

A diagram of a business

Description automatically generated

Fig. No. 7.2.1 Use-case diagram

1. **SEQUENCE DIAGRAM**

The **Sequence Diagram** provides a dynamic view of the system, depicting the sequence of interactions between objects over time. For the SignSpeak project, this diagram focuses on how different components of the system (camera, image processing, ML model, and GUI) work together. It shows the step-by-step process involved in capturing an image, processing it, running recognition algorithms, and returning the recognized sign as text to the user interface.

|  |  |  |
| --- | --- | --- |
| |  | | --- | |  | | Object |
| A graph paper with a line  Description automatically generated | Message |
| A black line drawing of a person  Description automatically generated | Actor |

Table 7.3.1 Sequence diagram symbols

A screen shot of a computer

Description automatically generated

Fig. No. 7.3.1 Sequence diagram

1. **ACTIVITY DIAGRAM**

The Activity Diagram outlines the flow of activities or tasks within the system. It is used to model the workflow of the SignSpeak project, showing the different actions a user can perform, from starting the camera to displaying the recognized text. It visualizes conditional flows, user choices (e.g., choosing between dark and light themes), and the system's reactions to these inputs. This diagram is beneficial for understanding the overall flow and process from the user’s perspective.

|  |  |
| --- | --- |
| A black circle with white background  Description automatically generated | Initial node |
| A black circle in a white circle  Description automatically generated | End symbol/node |
| A white grid with a black line  Description automatically generated | Action/Control Flow |
|  | Action/Activity |

Table 7.4.1 Class diagram symbols

A screenshot of a diagram

Description automatically generated

Fig. No. 7.4.1 Activity diagram

1. **DATA FLOW DIAGRAM**

The **Data Flow Diagram** (DFD) provides an overview of how data moves through the system. It represents how input (such as images from the camera) is processed, analyzed, and transformed into output (recognized text). In the context of SignSpeak, the DFD will illustrate how raw data (sign images) is passed through various stages—preprocessing, recognition using machine learning, and displaying text results. This helps in understanding the flow of information and the system's structure in terms of data handling.

|  |  |
| --- | --- |
| A white rectangular frame with black border  Description automatically generated | Entity |
| A long line of white text  Description automatically generated with medium confidence | Data flow |

Table 7.5.1 Data flow diagram symbols

A screenshot of a computer screen

Description automatically generated

Fig. No. 7.5.1 Data Flow Diagram