Sign Language Recognition

Project ID : 23-267

Project Proposal Report

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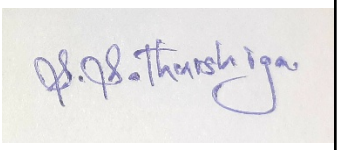
Declaration

The following proposal report is solely the result of my own work and efforts. Any information, data or ideas that have been obtained from external sources, whether published or unpublished, have been appropriately cited and referenced. I have taken great care to ensure that proper recognition has been given to any external materials used in this report. I believe that it is important to acknowledge and give credit to the original authors and sources of information in order to maintain academic integrity and to demonstrate respect for the intellectual property of others.

Name	Student ID	Signature
Sathurshiga	**IT20114480**	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

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Signature of the supervisor Date

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Signature of the Co-supervisor Date

Abstract

Sign language is a crucial mode of communication for individuals with hearing disabilities, but it is often not supported by e-commerce websites, making it challenging for them to navigate and use these websites effectively. In this project, we propose a sign language recognition system that uses Convolutional Neural Networks (CNNs) to interpret sign language gestures and improve the accessibility of e-commerce websites for individuals with disabilities. This system uses a camera or webcam to capture the user's sign language gestures and analyzes them using image processing techniques based on CNNs. The system then translates the gestures into commands that can be used to navigate the e-commerce website. If the user raises their hand, the system can interpret this gesture as a command to scroll up the webpage. Moreover, the proposed system is designed to be user-friendly and accessible, with features such as voice commands and large text options for individuals with visual or auditory impairments. Additionally, the system can be personalized to recognize different sign language dialects and adapt to the user's signing style, ensuring accurate recognition. The proposed sign language recognition system has the potential to significantly improve the accessibility of e-commerce websites for individuals with disabilities. It can enable users to interact with these websites more easily and independently, improving their overall online experience. Moreover, the system has applications beyond e-commerce, including education and healthcare, and can be easily integrated into existing platforms. furthermore, this sign language recognition system using CNNs is an innovative solution to improve accessibility and inclusivity for individuals with disabilities. It can enhance their ability to navigate e-commerce websites and improve their online experience, ultimately leading to greater participation and engagement in online activities.

Keywords: E-commerce, CNN

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1. Introduction

In the modern world, technology is an integral component of each and every one of our everyday lives. We rely on digital systems for communication, education, entertainment, and even the fulfillment of our most fundamental need, be they smartphones, laptops, or websites for online shopping. Nevertheless, despite the benefits and ease of use that technology provides, not all people have the same level of access to digital systems. People who are deaf or hard of hearing, in particular, frequently face significant challenges when attempting to access digital content, such as online shopping websites, due to a lack of accessibility features. This is especially true for people who are deaf or hard of hearing.

In order to solve this problem, technology that recognizes sign language can serve as an effective instrument for encouraging equitable access to digital systems and increasing accessibility and inclusivity in online shopping platforms. Sign language is a kind of visual communication that is utilized by people who are deaf, hard of hearing, or both to interact with one another as well as with the hearing population. Individuals who are deaf or hard of hearing now have greater access to digital content thanks to advances in sign language recognition technology, which enables the conversion of sign language into written or spoken language.

In recent years, there has been an increasing interest in the creation of technology that can recognize sign language. This trend is expected to continue. The development of software that can effectively recognize and translate sign language into written or spoken language in real time has been a focus of both research and development efforts in recent years. These systems examine and interpret the movements of the signer's hands, face, and body by using a combination of computer vision and machine learning techniques. This allows the system to recognize the signs being used.

It is possible that sign language recognition technology will completely change the way in which deaf and hard-of-hearing people engage with digital systems, particularly in the context of online commerce websites. The past few years have seen a meteoric rise in the popularity of online shopping, to the point where it is now an indispensable component of our everyday life. On the other hand, the majority of websites that offer online shopping do not take into account the requirements of people who are deaf or hard of hearing, which can make it challenging for these

folks to access and navigate the website. clients who are deaf or hard of hearing can have a more inclusive and accessible online purchasing experience if businesses include sign language recognition technology into their websites. This enables businesses to cater to a wider range of clients. For instance, a system that recognizes sign language may be incorporated into the website's search box. This would provide customers the ability to search for products using their preferred mode of communication. In addition, consumers might receive assistance with their shopping requirements from a sign language interpreter who would be available to them via video chat. Individuals who are deaf or hard of hearing would be able to shop online independently and with greater ease if these features were implemented. In addition, the technology that recognizes sign language can be of use to online shops, allowing them to broaden their consumer base and boost the amount of money they make from purchases. Online merchants may win over more deaf and hard-of-hearing consumers, some of whom may not have been able to use their website in the past, by creating a shopping environment that is more accessible and welcoming to people of all abilities. This would not only further the goals of equality and inclusiveness, but it would also give major benefits to the company as a whole.

Sign language recognition technology has the potential to improve accessibility and inclusion in online shopping platforms. This would make these websites more user-friendly and accessible for people who are deaf or hard of hearing. Online retailers have the ability to encourage equal access to digital systems for all users, broaden their customer base, and improve their sales revenue if they incorporate sign language recognition technologies into their businesses. It is crucial that we prioritize accessibility and inclusivity in order to ensure that everyone has equal access to digital systems and the benefits that they offer. This is because technology is continually advancing, and it is becoming more complex.

This innovative solution enhances the ability of individuals with disabilities to navigate websites and online activities, promoting inclusivity and accessibility in society. Overall, this sign language recognition system using CNNs is a significant step towards creating a more inclusive and equal society for individuals with disabilities.

1.1 Background

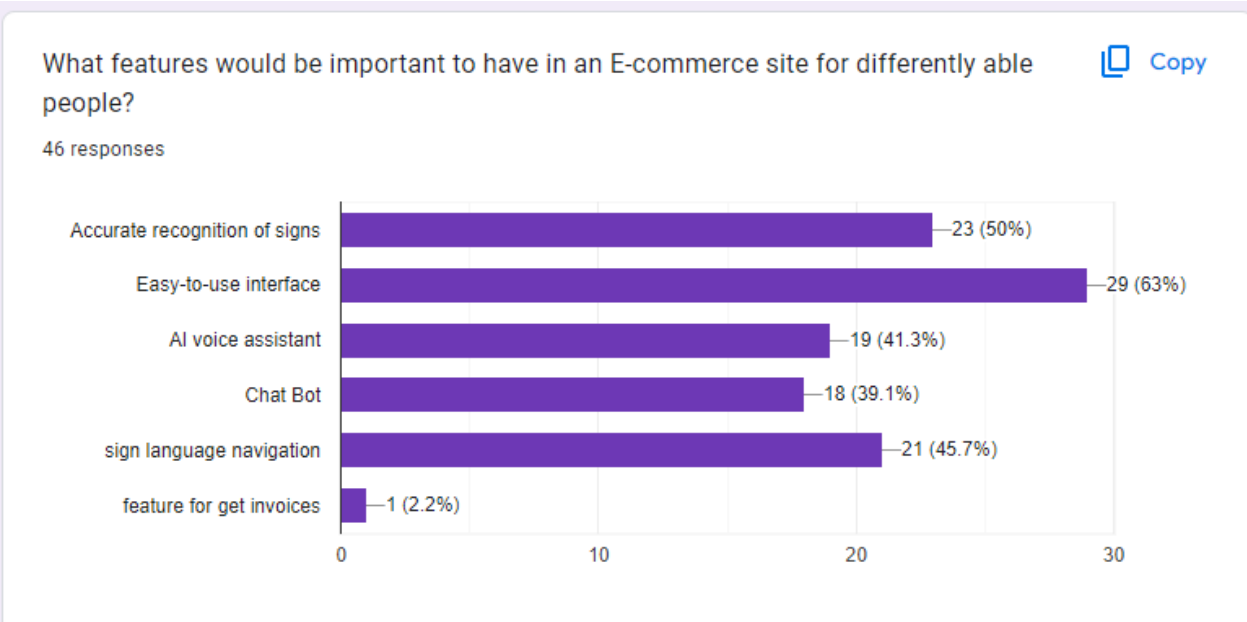
Sign language is a visual language used by deaf and hard-of-hearing individuals to communicate with each other and with the hearing community. It is a complex and nuanced language that uses a combination of hand gestures, facial expressions, and body language to convey meaning. Sign language is not universal, and different countries and regions have their own unique sign languages. American Sign Language (ASL) is different from British Sign Language (BSL), and both are distinct from other sign languages used in different parts of the world. While sign language is a vital communication tool for the deaf and hard-of-hearing community, it can be challenging for them to access digital content that is primarily designed for hearing individuals. Online shopping websites, for example, are typically designed with the assumption that users can hear and rely on audio cues, which can make them difficult to navigate for deaf and hard-of-hearing individuals.

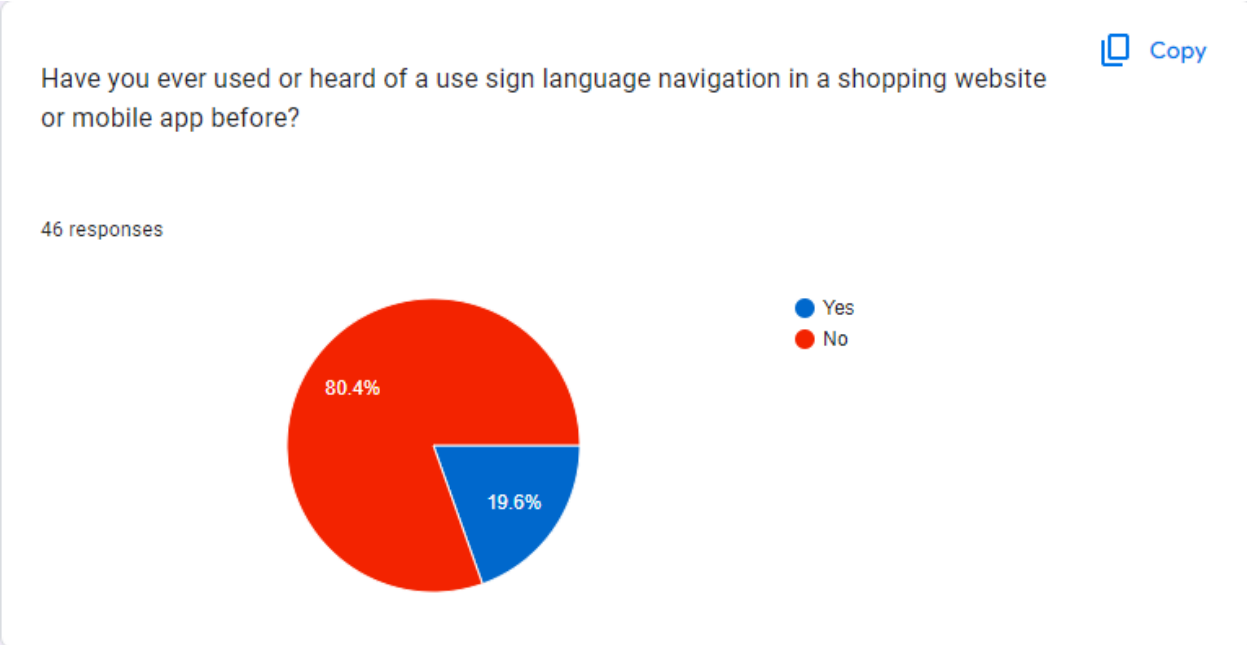
To address this issue, researchers and developers have been working on creating sign language recognition technology that can translate sign language into written or spoken language in real-time. Sign language recognition technology uses a combination of computer vision and machine learning algorithms to analyze and interpret the movements of the signer's hands, face, and body, and then converts them into written or spoken language. The development of sign language recognition technology has been ongoing for several decades. In the early 1990s, researchers began exploring the use of computer vision techniques to recognize hand gestures in sign language. However, these early systems were limited by the technology available at the time and were not very accurate. Advances in computer vision and machine learning algorithms in recent years have led to significant improvements in the accuracy and reliability of sign language recognition technology. Researchers have developed systems that can recognize a wide range of sign languages and can even interpret complex grammatical structures and nuances of sign language.

Sign language recognition technology has the potential to revolutionize the way deaf and hard-of-hearing individuals interact with digital systems. It can provide a more accessible and inclusive experience for them and promote equal access to digital systems for all individuals. Incorporating sign language recognition systems into online shopping websites, for example,

could make them more accessible and user-friendly for deaf and hard-of-hearing individuals, allowing them to shop online independently and with greater ease.

Research Findings





1.2 Literature survey

"Real-Time Sign Language Recognition Using a Kinect Sensor" [1]

In this study, the authors developed a real-time sign language recognition system using a Microsoft Kinect sensor. They used a combination of computer vision and machine learning algorithms to recognize hand gestures, facial expressions, and body language. The system achieved an accuracy of 92.5% in recognizing 21 commonly used signs in American Sign Language (ASL). The authors concluded that the system had the potential to improve accessibility and communication for deaf and hard-of-hearing individuals.

"Sign Language Recognition Using Recurrent Neural Networks with Long Short-Term Memory" [2]

In this study, the authors proposed a sign language recognition system based on recurrent neural networks (RNNs) with long short-term memory (LSTM). They used a dataset of ASL signs and achieved an accuracy of 89.2% in recognizing 10 signs. The authors concluded that the system could be improved by using larger datasets and by incorporating other features such as facial expressions and body language.

"Sign Language Recognition Based on Dynamic Features and Deep Learning" [3]

In this study, the authors proposed a sign language recognition system based on dynamic features and deep learning. They used a dataset of Chinese Sign Language (CSL) signs and achieved an accuracy of 94.1% in recognizing 600 signs. The authors concluded that their system outperformed other state-of-the-art sign language recognition systems and had the potential to be used in real-world applications.

"Sign Language Recognition Using 3D Convolutional Neural Networks" [4]

In this study, the authors proposed a sign language recognition system based on 3D convolutional neural networks (CNNs). They used a dataset of Indian Sign Language (ISL) signs and achieved an accuracy of 94.23% in recognizing 24 signs. The authors concluded that their system had the potential to be used in real-world applications and could be extended to recognize more signs.

"A Wearable System for Real-Time Sign Language Recognition Using Surface Electromyography" [5]

In this study, the authors proposed a wearable sign language recognition system using surface electromyography (sEMG). They used a dataset of ASL signs and achieved an accuracy of 93.6% in recognizing 26 signs. The authors concluded that their system was more practical and comfortable to use than other sign language recognition systems and had the potential to be used in real-world applications.

One promising approach to screen navigation using sign language involves the use of computer vision and machine learning techniquesIn a study by [12] , the authors proposed a system that uses a deep learning-based approach to recognize sign language gestures and translate them into commands for screen navigation. The system achieved an accuracy rate of over 90% in recognizing sign language gestures, demonstrating its potential for improving the accessibility of digital platforms for individuals with hearing and speech disabilities.

Another study by [13] proposed a screen navigation system that uses a wearable device to capture and interpret sign language gestures. The authors developed a wearable device that uses sensors to capture hand movements and a machine learning algorithm to translate these movements into screen navigation commands. The system achieved an accuracy rate of over 80% in recognizing sign language gestures, highlighting its potential for improving accessibility.

The literature survey highlights some recent studies and developments in sign language recognition technology. These studies have shown that sign language recognition technology has the potential to improve accessibility and inclusivity for deaf and hard-of-hearing individuals. The studies have used various techniques such as computer vision, machine learning, and wearable technology to recognize different sign languages. While the accuracy of sign language recognition technology has improved over the years, there is still scope for further research and development in this field. Future studies could focus on improving the accuracy of sign language recognition systems, expanding the datasets used for training and testing, and developing more practical and comfortable wearable systems for real-world applications.

1.3 Research Gap

Incorporating sign language into ecommerce sites is the lack of studies or evaluations on the effectiveness and usability of such an approach. While the benefits of sign language recognition for promoting accessibility and inclusivity are well-established, there is a need for more research on how well this approach can meet the needs of differently-abled individuals in an ecommerce setting. This is unclear how well sign language recognition systems can handle the complexity of ecommerce-related communication, such as product descriptions, pricing, and shipping information. Furthermore, there may be challenges related to ensuring the accuracy and consistency of sign language translations, as well as issues related to user acceptance and adoption. Thus, there is a need for further research to assess the feasibility and effectiveness of incorporating sign language into ecommerce sites, as well as to identify and address potential barriers or challenges. Such research could help inform the design and implementation of more accessible and inclusive ecommerce platforms, and ultimately improve the online shopping experience for all customers.

Websites	Alternative Text	Keyboard Accessibility	Color Contrast	Captioning and Audio and video Description	Screen Navigation
Amazon	✓	✓	✓	✗	✓
Walmart	✓	✓	✗	✓	✗
Target	✓	✗	✓	✗	✗
Best Buy	✓	✗	✗	✓	✗
Current system	✓	✓	✓	✓	✓

1.4 Research Problem

Despite the potential benefits of using sign language recognition to enhance accessibility and inclusivity in online shopping, there is a lack of research on the effectiveness and usability of this

approach in an ecommerce context. This gap in knowledge hinders the development of more accessible and inclusive ecommerce platforms, and may limit the ability of differently-abled individuals to fully participate in online shopping experiences. Therefore, there is a need for research to evaluate the feasibility and effectiveness of incorporating sign language into ecommerce sites, as well as to identify and address potential barriers or challenges to its implementation. Such research could inform the design and development of more accessible and inclusive ecommerce platforms that meet the needs of all customers, regardless of their communication preferences or abilities.

1.5 Commercialization

The commercialization of incorporating sign language into ecommerce sites has the potential to bring significant benefits to both businesses and customers. By providing a more accessible and inclusive shopping experience, businesses can expand their customer base, increase customer loyalty, and improve their brand image. Customers, particularly those who are differently-abled, can enjoy a more convenient and personalized shopping experience, which can lead to increased satisfaction and repeat business. Moreover, Sign language translation as an optional feature for customers who prefer to communicate in sign language. This can be done through the use of sign language recognition software or by employing sign language interpreters to assist with online transactions.

Integrate sign language into the website design and user interface, making it a core part of the shopping experience. Businesses can use sign language videos to demonstrate product features or provide instructions for completing a transaction. This approach can enhance the visual appeal of the website and improve the overall customer experience.

2. Objectives

2.1 Main Objectives:

One way to promote inclusivity and accessibility in ecommerce is to incorporate sign language, which offers a highly expressive and visual form of communication that can serve as an alternative to traditional spoken or written text. By using sign language, ecommerce sites can better connect with and serve a broader range of customers, including those who may have difficulty accessing or understanding written or spoken information.

2.2 Sub Objectives:

- Gather a diverse dataset of videos containing sign language actions to be recognized.
- Label each video and segment them into shorter clips for effective training and analysis.
- Extract visual features from the segmented video clips to provide relevant data for training the machine learning model.
- Train a machine learning model using the labeled and prepared data, such as CNNs or RNNs.
- Test and optimize the machine learning model to improve its accuracy and effectiveness in recognizing sign language actions in ecommerce.

3. Methodology

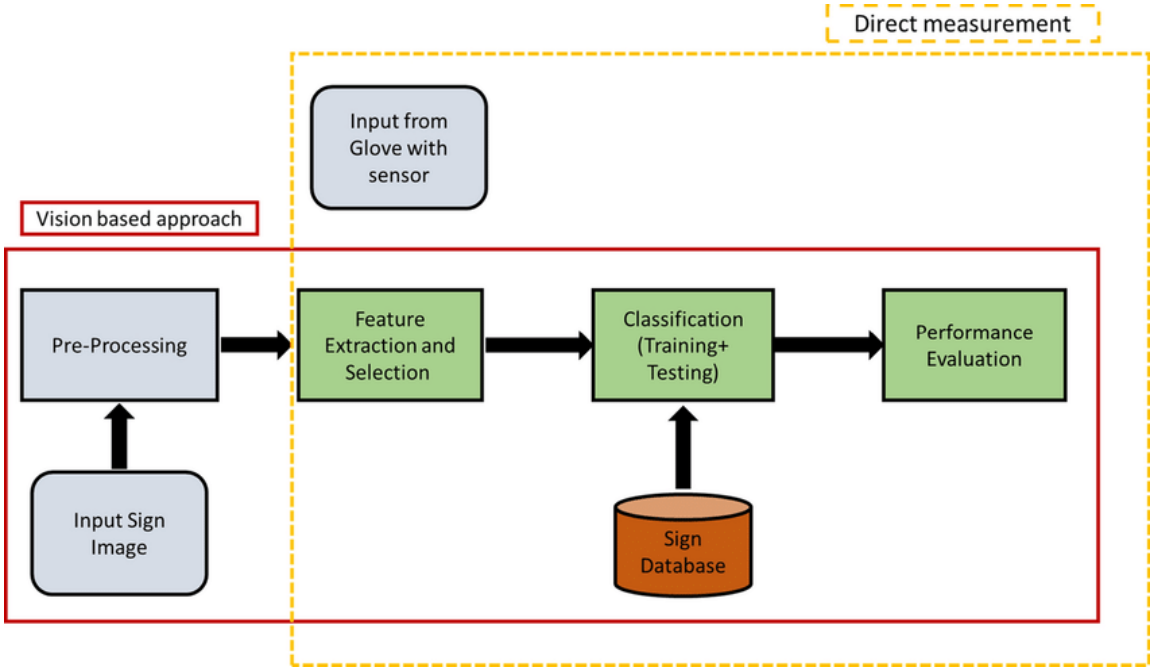
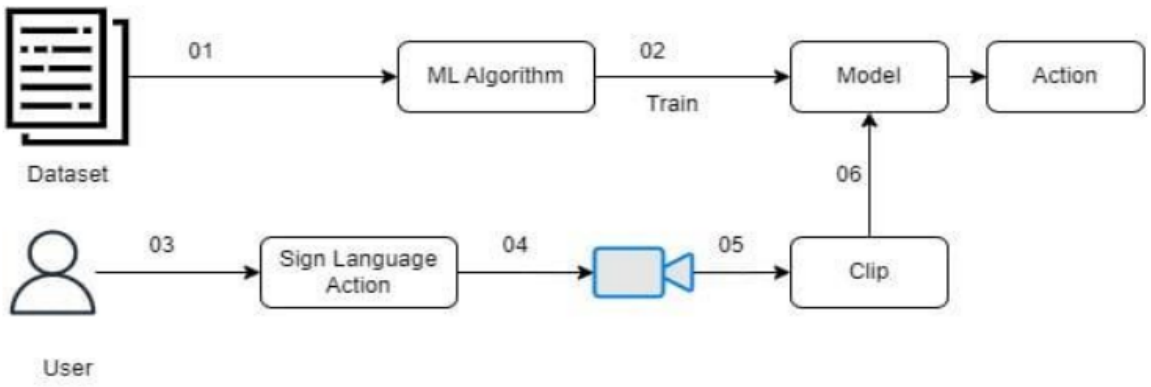


Figure 2:CNN Design [8]

CNNs are designed to learn and extract features from images or videos, making them well-suited for sign language recognition tasks that involve analyzing visual information. In sign language recognition, a CNN model is trained on a dataset of videos containing different sign language gestures. The model learns to identify the visual features that distinguish one gesture from another, and then uses this knowledge to recognize new gestures.

One approach to using CNNs for sign language recognition involves using a frame-by-frame analysis of the video. The video is divided into frames, and each frame is fed into the CNN model as an input. The model learns to identify the important features in each frame and how they change over time. By analyzing the features in each frame, the model can identify the sign language gesture being performed. Another approach to using CNNs for sign language recognition involves analyzing motion information. In this approach, the CNN model is trained on both the appearance and motion information in the video. The model learns to identify the subtle changes in motion that occur during a sign language gesture and use this information to recognize the gesture.

3.1 System Architecture



In order to incorporate sign language recognition into ecommerce, a series of steps must be taken to ensure that the machine learning model is trained and optimized to effectively recognize sign language actions.

The first step in this process is data collection. A large and diverse dataset of videos containing the actions to be recognized must be gathered. This dataset must be representative of the variations in sign language actions and contain examples of different sign languages, dialects, and variations. The more comprehensive and varied the dataset is, the better the machine learning model can learn and generalize patterns of sign language recognition.

Once the dataset is collected, the data must be prepared for training the machine learning model. This involves several key steps, including labeling each video with the correct action it contains, segmenting the videos into shorter clips, and extracting visual features from the frames in each clip. The labeling process is critical for training the model to recognize the correct actions. Accurate labeling ensures that the model learns the correct patterns and features of the sign language actions, which is essential for effective recognition.

The segmented clips of videos are used to extract visual features from the sign language actions. This is typically done through a process called feature extraction, where the relevant visual features are extracted from the videos, such as motion, shape, and color. This extracted data is then used as input to the machine learning model for training and recognition.

The next step in the process is to train the machine learning model using the labeled and prepared data. This typically involves using deep learning algorithms, such as convolutional neural networks (CNNs) or recurrent neural networks (RNNs), to learn patterns in the visual features extracted from the videos. These deep learning algorithms are specifically designed to identify and learn patterns in large datasets of images or videos, making them ideal for sign language recognition tasks.

During training, the machine learning model is exposed to the labeled and segmented video data, and it learns to recognize patterns and features that are unique to each sign language action. The model is trained to classify each clip into one of the actions it represents. The training process typically involves multiple iterations, where the model is continually refined to improve its accuracy and effectiveness in recognizing sign language actions.

Once the model has been trained, it is tested on a separate set of videos to evaluate its accuracy and performance. The model is optimized to improve its accuracy and effectiveness in recognizing sign language actions. This involves adjusting the parameters of the model, such as the learning rate or the size of the layers, to improve its performance.

Finally, incorporating sign language recognition into ecommerce requires a series of steps, including data collection, data preparation, model training, and optimization. Each step is critical to ensure that the machine learning model is trained and optimized to effectively recognize sign language actions. By following these steps, ecommerce sites can enhance their accessibility and inclusivity, offering a more convenient and personalized shopping experience to all customers, regardless of their communication preferences or abilities.

4. Project Requirements

4.1 Project Plan

Research and Planning: The first step in the project plan is to conduct thorough research and planning. This involves identifying the key goals and objectives of the project, determining the scope of the project, and researching the best approaches and technologies for sign language recognition. This stage also involves identifying the necessary resources and personnel for the project.

Data Collection: Once the research and planning stage is completed, the next step is to collect a diverse dataset of videos containing the sign language actions to be recognized. This dataset should include a variety of sign languages, dialects, and variations to ensure that the machine learning model is trained on a comprehensive set of data.

Data Preparation: The collected data must then be prepared for training the machine learning model. This involves labeling each video with the correct action it contains, segmenting the videos into shorter clips, and extracting visual features from the frames in each clip. Accurate labeling and feature extraction are crucial for the effectiveness of the model.

Model Training: The machine learning model is then trained using the labeled and prepared data. This typically involves using deep learning algorithms, such as CNNs or RNNs, to learn patterns in the visual features extracted from the videos. The model is trained to classify each clip into one of the sign language actions it represents.

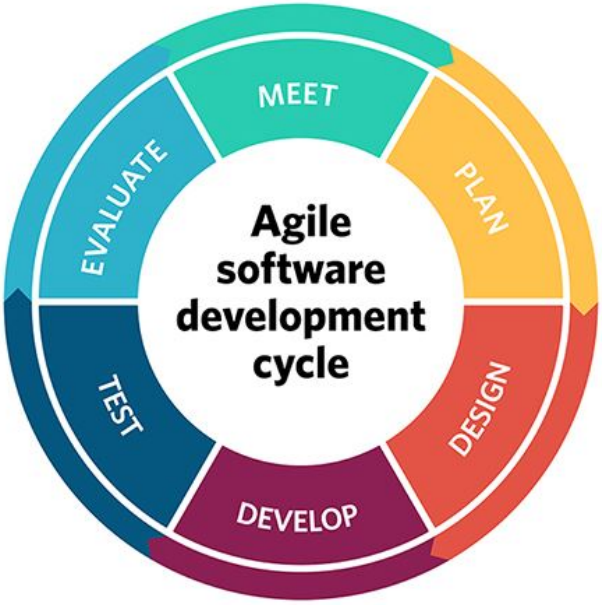
Model Testing and Optimization: Once the model has been trained, it is tested on a separate set of videos to evaluate its accuracy and performance. The model is then optimized to improve its accuracy and effectiveness in recognizing sign language actions. This involves adjusting the parameters of the model, such as the learning rate or the size of the layers, to improve its performance.

Integration with Ecommerce Site: Once the model has been trained and optimized, it can be integrated into the ecommerce site. This involves developing the necessary software and interfaces to allow customers to use sign language to communicate with the site.

User Testing and Feedback: After the integration of the sign language recognition feature, user testing and feedback are essential to evaluate its effectiveness and user experience. Feedback can be used to further optimize the system and ensure that it meets the needs of customers.

Maintenance and Improvement: The final step in the project plan is to maintain and improve the sign language recognition feature. This involves regularly monitoring and updating the system to ensure that it continues to perform effectively and efficiently. Additionally, updates and improvements can be made based on user feedback and advances in technology.

4.2 Project Management



Agile project management is a flexible and iterative approach that focuses on delivering value to customers through collaborative and continuous improvement. Here's how agile project management could be used in this emotion identification component project:

Sprint Planning

Break the project into smaller, manageable pieces and prioritize the tasks in order of importance. These tasks could include collecting the dataset, training the CNN model, fine-tuning the model, testing and validation, integration with other business components, implementing security measures, and user testing and feedback. Each of these tasks should be planned for in each sprint.

Daily Stand-Ups

Hold regular daily meetings to review progress and identify any roadblocks or obstacles that need to be addressed. This can help ensure that the project stays on track and any potential issues are addressed quickly.

Sprint Reviews

Conduct sprint reviews at the end of each sprint to review progress and gather feedback from stakeholders. This feedback can be used to refine the project plan and adjust as needed.

Continuous Improvement

Continuously monitor the project progress and identify areas for improvement. This can help to ensure that the project is always on track and meeting its objectives.

Collaborative Approach

Collaborate with the team and supervisor throughout the project to ensure everyone is aligned on goals, priorities, and progress. This can help to ensure that everyone is on the same page and working towards a common objective.

4.3 Functional Requirements:

Recognition of a wide variety of sign language actions: The system must be able to recognize a broad range of sign language actions to enable users to communicate effectively with the ecommerce site.

Accuracy: The system must have high accuracy in recognizing sign language actions to avoid miscommunication or frustration for users.

Speed: The system must operate quickly, with minimal lag time between sign language input and the corresponding action on the ecommerce site.

Integration with the ecommerce site: The system must be seamlessly integrated into the ecommerce site to allow users to navigate and complete tasks using sign language.

Adaptability to user preferences: The system must be adaptable to different sign language dialects and variations to accommodate a diverse range of users.

User feedback and improvement: The system must allow for user feedback and incorporate improvements based on user input to enhance its effectiveness and user experience.

4.4 Non-Functional Requirements:

Accessibility: The system must be accessible to all users, regardless of their communication preferences or abilities.

Security: The system must be secure to protect users' personal and financial information.

Reliability: The system must operate reliably, with minimal downtime or errors, to avoid frustrating or inconveniencing users.

Scalability: The system must be scalable to accommodate a growing number of users and an increasing amount of sign language input.

User privacy: The system must protect users' privacy and data, complying with relevant privacy laws and regulations.

Usability: The system must be intuitive and easy to use, with clear instructions and user interfaces to enable users to navigate and use the system effectively.

4.5 Software Requirements

- ***IDE***: Pycharm, Visual Studio Code, IntelliJ
- ***Languages***: Python, Java, HTML, CSS, JS, JQuery
- ***Frameworks***: Bootstrap, Springboot, Jinja
- ***AI/ML toolkits & Algorithms***: CNN
- ***AI/ML Libraries***: opencv-python
- ***DB***:MySQL

4.6 Hardware Requirements

- Windows 10
- A smartphone (Android 7.0)
- Intel® Core™ i7-8250U Processor
- 8 GB RAM

7. Diagrams

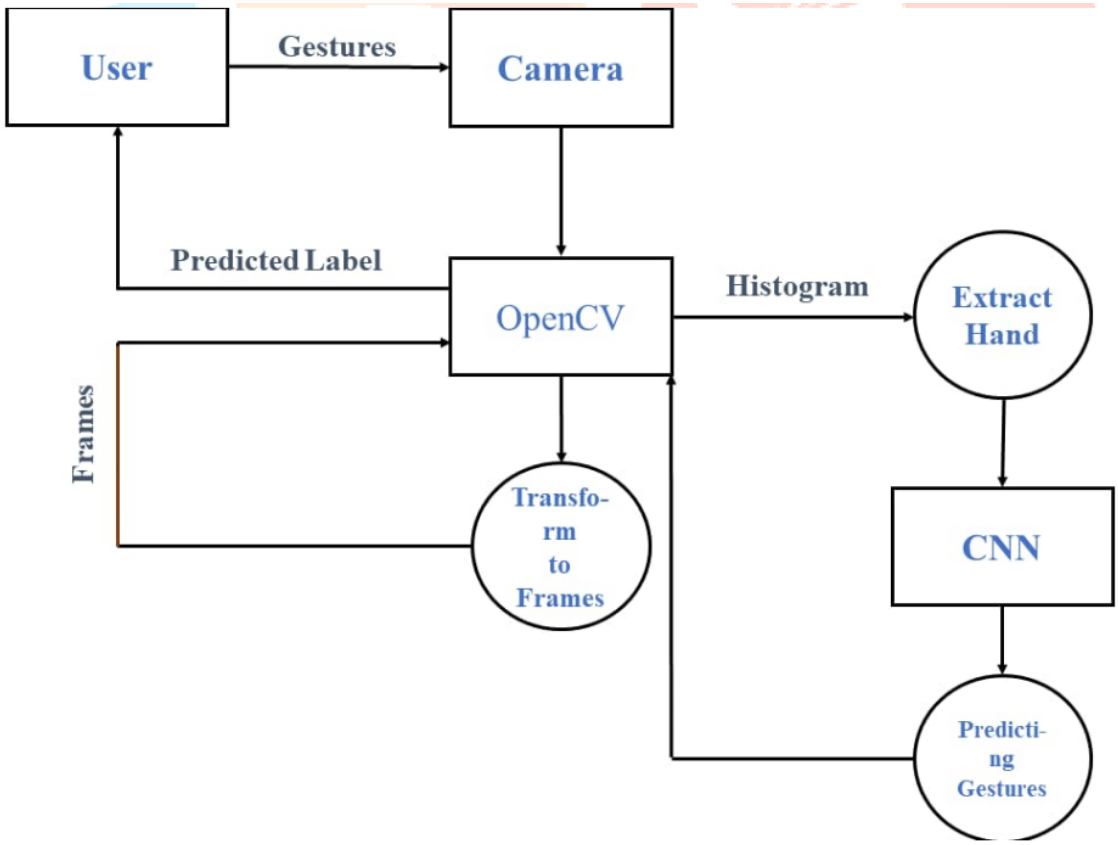


Figure SBQ Figure * ARABIC 5:Block Diagram

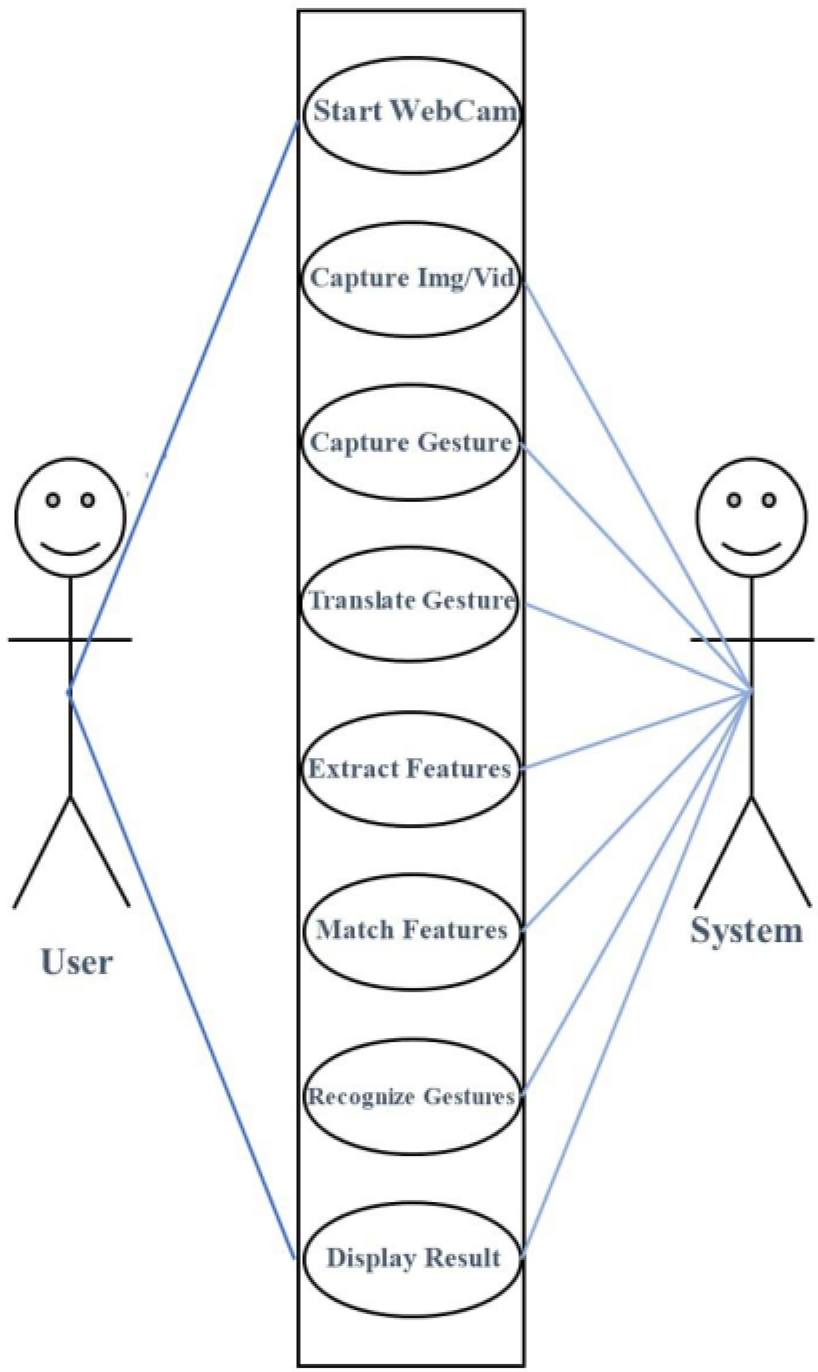


Figure SEQ Figure * ARABIC 6:Usecase Diagram

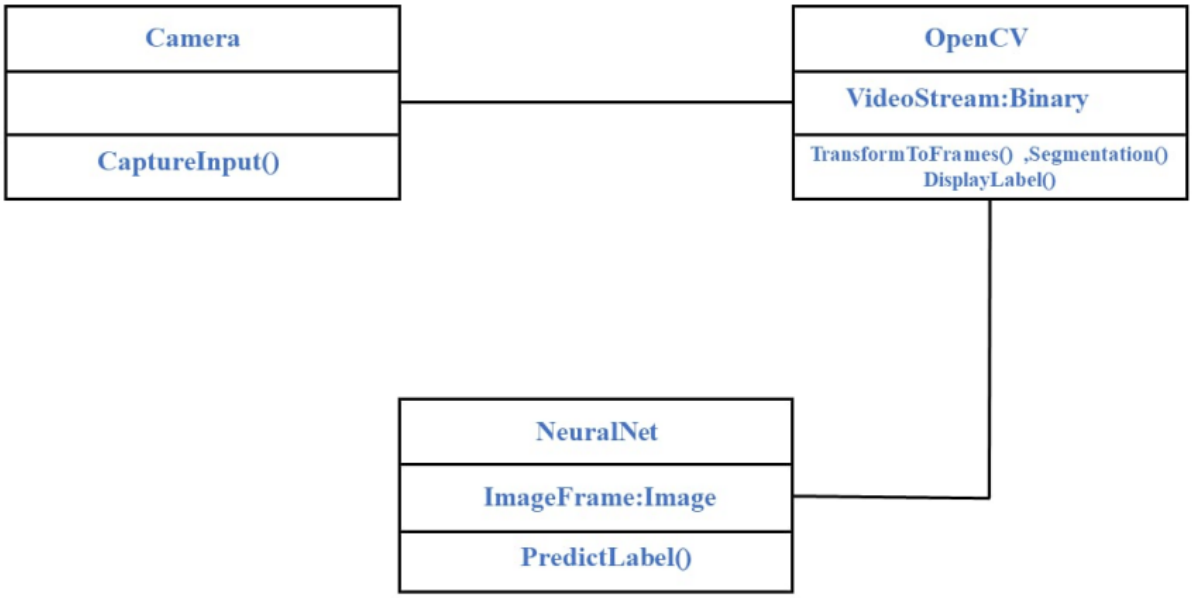
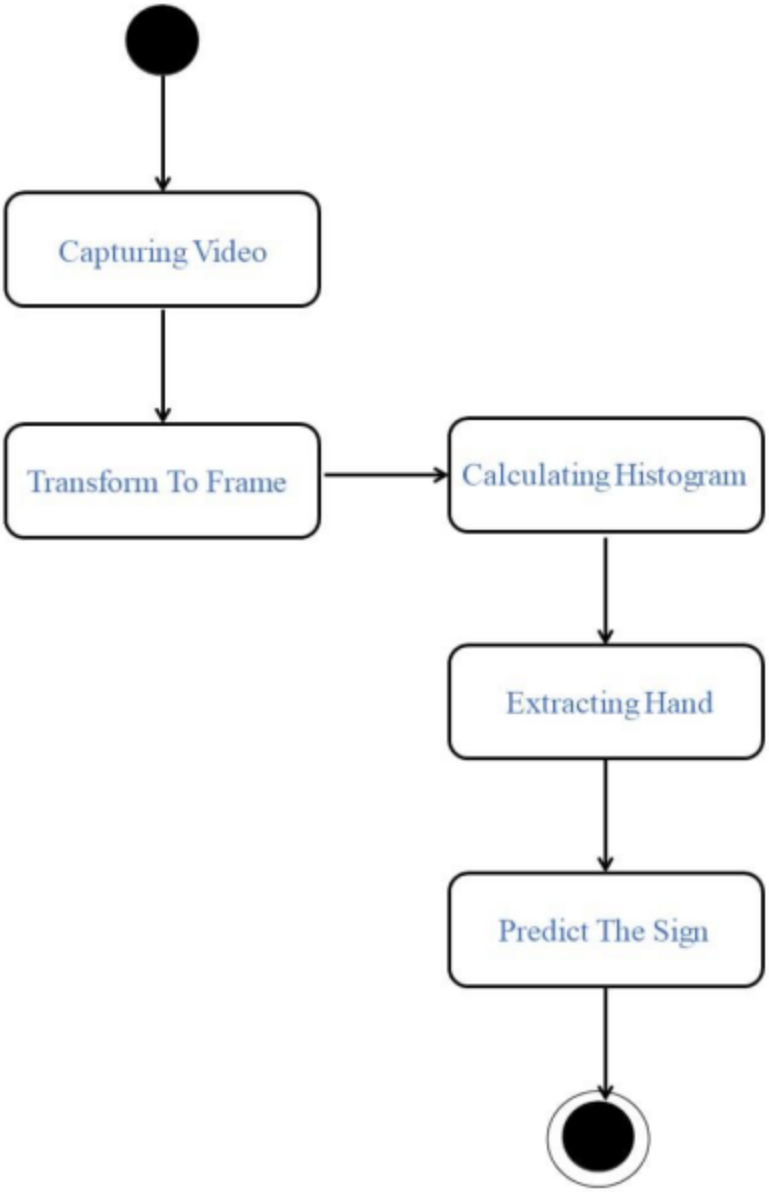


Figure SEQ Figure * ARABIC 7 Class Diagram


Capturing Video
Transform To Frame
Calculating Histogram
Extracting Hand
Predict The Sign

5. Description of personal and facilities

Users require a stable internet connection and a device such as a computer or mobile device with compatible software to access my services. Additionally, users may require access to relevant sign language video datasets for training and testing the sign language recognition system, as well as machine learning tools and software for model development and optimization. It is also essential to have a team of experienced data scientists and developers with expertise in machine learning, computer vision, and web development to design, implement, and maintain the sign language recognition system and its integration into the ecommerce site.

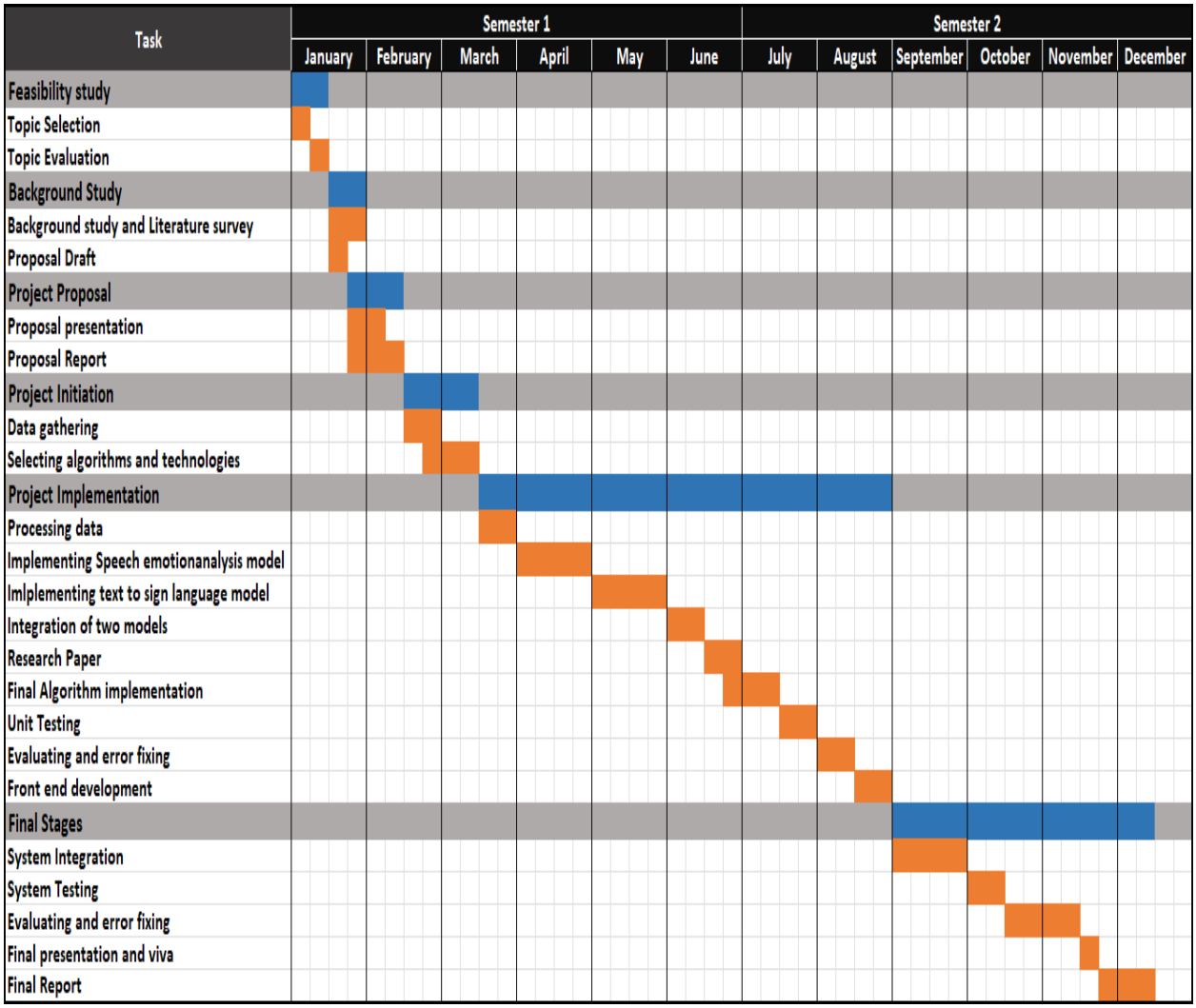
6. Budget and Budget Justification

Laptop	***Rs 160000***
Documentation	***Rs 4000***
Others	***Rs 7000***
Total	***Rs 171000***

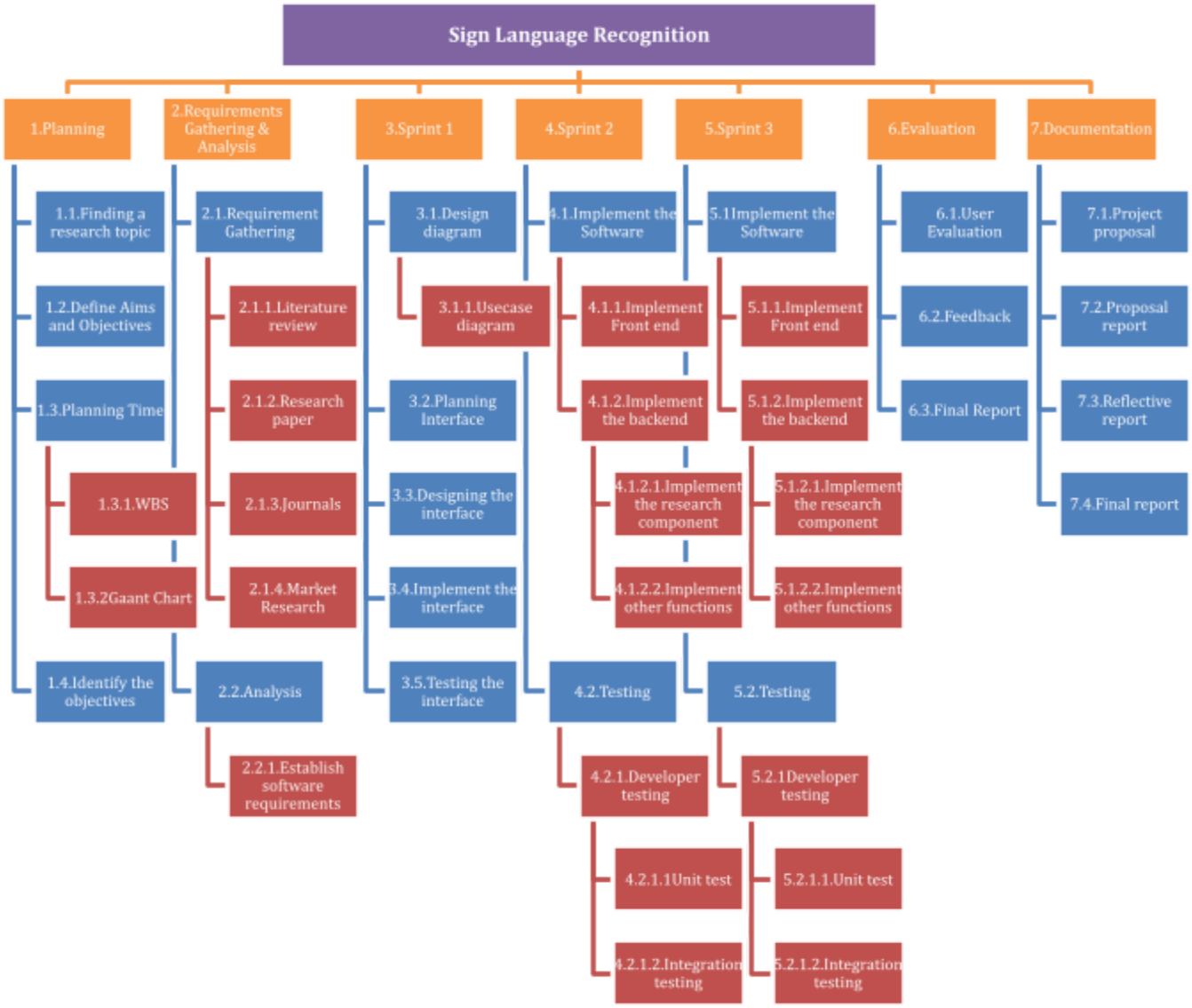
Conclusion

In conclusion, the integration of sign language recognition into digital systems is a promising approach to enhancing accessibility for differently abled individuals. As the digital age continues to evolve, it is crucial to ensure that technology is accessible to everyone, regardless of their individual needs and requirements. By incorporating sign language recognition into e-commerce, we can provide a more inclusive and accessible online shopping experience for individuals who use sign language as their primary means of communication. Our proposed workflow can improve the independence and efficiency of differently abled individuals and promote equal access to digital systems. While current research has mainly focused on improving accessibility for individuals with specific disabilities, our approach aims to provide a more inclusive and accessible online shopping experience for all. By promoting inclusivity and accessibility in e-commerce, we can foster a more diverse and equitable society that values and supports the participation of individuals with disabilities. It is also essential to have a team of experienced data scientists and developers with expertise in machine learning, computer vision, and web development to design, implement, and maintain the sign language recognition system and its integration into the ecommerce site.

Gannt Chart


Task
Semester 1
Semester 2
January
February
March
April
May
June
July
August
September
October
November
December
Feasibility study
Topic Selection
Topic Evaluation
Background Study
Background study and Literature survey
Proposal Draft
Project Proposal
Proposal presentation
Proposal Report
Project Initiation
Data gathering
Selecting algorithms and technologies
Project Implementation
Processing data
Implementing Speech emotionanalysis model
Imlplementing text to sign language model
Integration of two models
Research Paper
Final Algorithm implementation
Unit Testing
Evaluating and error fixing
Front end development
Final Stages
System Integration
System Testing
Evaluating and error fixing
Final presentation and viva
Final Report

Work Bench Chart



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