**1.0 Introduction**

**1.1 Background**

Development of language as a communication medium was a huge achievement in evolution, and there is no human community without it. Humans have a natural tendency for language in two different modalities: vocal-auditory and manual-visual (Sandler,2003). Since the beginning of civilizations, vocal-auditory modality was the predominant method. According to Meadow (2000) speech is the predominant medium for its transmission and it seems that spoken languages themselves are either also very old or are descended from other languages with a long history. On the other hand [Fischer](https://www.researchgate.net/profile/Susan_Fischer4) (2015) stated that sign languages do not have the same histories as spoken languages because special conditions are required for them to arise and persevere, and for this reason they can offer unique insight into essential features of human language. The [visual](https://en.wikipedia.org/wiki/Visual_language) recorded history of sign language in Western societies starts in the 17th century, as a [language](https://en.wikipedia.org/wiki/Visual_language) or method of communication (Sandler, Wendy, Martin (2006). At present, sign language can be interpreted as a unique system of conventional gestures, mimic, hand signs and finger spelling, plus the use of hand positions to represent the letters of the alphabet, ideas or phrases (Bauman & Dirksen,2008).

Sign language may be categorized into two types. “The first is used by individuals who have accesses to vocal-auditory language and the signs are used for special situations, such as in military communication and when practicing monastery rituals.

The second is used by those who do not have access to vocal-auditory language, namely the deaf(Ruben,2005) and deaf-mute people. Deaf-mute is a term which was used historically to identify a person who was either deaf using a sign language or both deaf and could not speak.

Many natural languages have created their own sign language system with different grammar, syntax, and vocabulary. Each displays the kinds of structural differences from the country’s spoken language that show it to be a language in its own right. (Sacks, 1989)

For example, ASL and British Sign Language are different, mutually unintelligible languages since the American and British Deaf communities were not in contact with each other, the two languages developed independently Perlmutter,2018). French Sign Language, Danish Sign Language, Taiwan Sign Language, Australian Sign Language, Thai Sign Language, Finnish Sign Language, Brazilian Sign Language, and many others have developed in communities of Deaf people, just as spoken languages have developed in communities of hearing people (National Institute on Deafness and Other Communication Disorders,2019)

Among those Sinhala Sign Language is a [visual language](https://en.wikipedia.org/wiki/Sign_language) used by [deaf](https://en.wikipedia.org/wiki/Deaf) people in Sri Lanka. Sri Lankan Sign Language was fully built on the foundation of British Sign Language but have lots of variations (Wikipedia, 2019). Sri Lankan Sign Language currently consists of more than 2000 sign based words.

Presentation of sign language consist of two techniques. They are established or productive signs and fingerspelling. In any sign language there are signs allocated for particular nouns, verbs and phrases. These signs are frequently used and highly standardized. These are known as established signs.

These signs are “frozen” and form the basis of the vocabulary listed in dictionaries of sign language. Productive signs make use of a much larger and more varied selection of locations and movements than established signs. These signs are actively created by signers as they put together combinations of meaningful units. This explains why these are called “productive” signs. These “meaningful units” can be used to extend or modify the meaning of established signs.

Examples of meaningful units are: handshape, hand orientation, sign location and movement, non-manual features, rate, stress, duration and repetition. Productive signs combine different meaningful units in different combinations as the need arises to produce signs that may have never been signed before but can be understood in a particular context. In any given signed conversation there is most probably a significant number of signs which have been created or re-created on the spot as required by the topic or context of the discussion.

Fingerspelling is using your hands to represent the letters of a writing system. In English, this means using 26 different hand configurations to represent the 26 letters of the English alphabet. As such, fingerspelling is not a signed language in and of itself, rather it is a manual code for representing the letters of the English alphabet. Among deaf and mute individuals, finger spelling is more often used in conjunction with sign language for proper names and terms for which there are no signs. It appears that fingerspelling was first used by hearing people to represent the written form of spoken language; however, fingerspelling is now completely integrated into natural signing.

According [Fischer](https://www.researchgate.net/profile/Susan_Fischer4) (2015),fingerspelling is occasionally integrated with established signing, and particularly use when addressing names of peoples and objects.

The only time fingerspelling might be exclusively used is in an educational setting such as the Rochester Method, or with deaf/blind people (or in very dark lighting conditions) whereby the letters are spelled onto the hand of the deaf/blind person. (Jhonston & Schemberi,2007)

According to Sri Lankan Federation of the Deaf, there are over three hundred thousand plus (300,000+) Deaf people in Sri Lanka. Moreover, the World Health Organization has revealed that approximately 9% of the population in Sri Lanka have speaking and hearing impairments. The reasons for these disabilities are not mere due to birth issues. According to Department of Census and Statistics Sri Lanka road accidents, riots and violence and war and terrorism are also among major reasons which creates speaking and hearing impairments.

As a result of that Sign language is an extremely important communication tool for deaf and hard-of-hearing people. There are only few number of people who are competent on Sinhala sign language and hence create a great difficulty for deaf people to engage in their social life and endeavors. Other people have to learn the sign language to communicate with deaf people and same might be useful to themselves due to other unfortunate factors which create speaking and hearing impairments as mentioned above.

There is a lack of interest in the natural persons to learn SSL. And because of that deaf and mute people cannot interact with the normal people and eventually the deaf people get isolated in the society.

It simply takes time to learn sign language when compared to a natural language since it takes communications to a completely different level and demands that you master eye gazing to better navigate the give-and-take of communal interactions. Additionally, there is only few number of people who can teach the Sinhala sign language best.

It is much convenient to both normal persons and deaf and mute people if there is an effective device based real-time translator.

**1.2 Problem Definition**

The existing applications on the topic are standalone learning applications of sign language for a beginner and does not support real time applications. The real time sign language translating applications are still in the research levels for English languages and many other languages. Also for Sinhala sign language. Majority of them are focusing on developing electronic devices. But it requires more power supply and it is very costly. So some researches use the static hand gesture recognition system using digital image processing.

Hand gestures can be different from person to person. The length, size can be different. So have to use machine learning to identify similar hand gestures when using image processing for identify the hand gestures allocated for a particular sign. other applications that are converting Sinhala sign language into text did not use machine language.

The systems that are translating Sinhala sign languages translate words and phrases into text only. There are no systems that are translating Sinhala sign language for Sinhala letters into Sinhala letter texts. Current systems are only capable of identifying few number of words and sentences among 500+ Sinhala sign language. To identify the rest, each word has to be inserted to their system.

Alphabet of Sinhala language only consist of 60 letters. Since letters are the building blocks of any language, converting signs based on letters to text can increase the horizons to identify and translate almost any word.

Therefore, this research is based on creating real time Sinhala sign language translator based on letter based signs using image processing and machine learning with the intention of achieving effective communication platform for people with visual and verbal impairments.

**1.3 Motivation**

Differently abled individuals are common element of any human society. But due to communication barrier they got neglected from the main society. People are reluctant to learn sign language to build up an effective communication platform with deaf or deaf and mute people. To make them feel involved and respected, effective communication bridge has to be adopted between deaf people and rest of the society.

The existing applications on the topic are standalone learning applications of sign language for a beginner and does not support real time applications. The real time sign language translating applications are still in the research levels for English languages and many other languages.

Hence his research is based on creating real time Sinhala sign language translator based on letter based signs using image processing and machine learning. ~~End product may be capable of tracking the hand gestures of Sinhala sign language for letters and print it in a text field on the user’s device.~~ ( can we use “may be” in a research?)

**1.4 Aim and Objectives**

**Aim**

Creating an effective communication platform for deaf and mute people in the society through real time Translation of Sinhala Sign Language into text through recognition of alphabet based signs

**Objectives**

1.Review the prevailing techniques and measures on real time sign language translation

**2 and 3 have to discussed**

4. Develop an application which is embedded with the capability of translating Sinhalese sign language into text through recognition of alphabet based signs.

**1.5 Limitations**

There are 60 letters in Sinhala alphabet. Correspondingly there are 60 signs to denote each letter. There are 2 types of hand signs indications for those letters as static hand signs and dynamic hand signs. This research has been limited only to recognition of static hand signs. (Has to revised)

**1.6 Major achievements**

This research proposes a method to convert letter based hand signs into text using combination of image processing techniques and machine learning techniques.

( At the END of research)

* 1. **Structure of the Dissertation (Thesis? )**

***Chapter one- Introduction***

This chapter gives a general overview of the research and guides to the content of the study while presenting the background of the study, aim and objectives, scope and limitations of the study and methodology adopted.

***Chapter two: Literature Review***

The second chapter includes the previous works for the identification and translation of sign language. It comprehensively discusses about the techniques for image preprocessing.

***Chapter Three: Research Methodology***

The third chapter describes the theoretical concepts of image processing and fuzzy logic behind on the research. Then it explains method of the project which is carried out to perform hard exudates detection successfully. It contains three stages for image preprocessing, exudates detection and hard exudates detection.

***Chapter Four: Analysis and Research Findings***

Findings through interviews have been critically analyzed within this chapter while elaborating how the research objectives were accomplished

***Chapter Five: Conclusion and Recommendations***

The conclusions of the overall research presented in this chapter together with preferred further researches.

**References**

Bauman, Dirksen (2008). *Open your eyes: Deaf studies talking*. University of Minnesota Press. [ISBN](https://en.wikipedia.org/wiki/International_Standard_Book_Number) [0-8166-4619-8](https://en.wikipedia.org/wiki/Special:BookSources/0-8166-4619-8).

[Fischer](https://www.researchgate.net/profile/Susan_Fischer4) S.D, Sign languages in their Historical Context Chapter (PDF Available) · January 2015

DOI: 10.13140/2.1.2085.5683

In book: The Routledge Handbook of Historical Linguistics, Chapter: Sign Languages in their Historical Context, Publisher: Routledge, Editors: Claire Bowern & Bethwyn Evans, pp.442-465

Perlmutter D.M. (2018) *What is sign language ?* The Linguistic Society of America.Retreived from <https://www.linguisticsociety.org/sites/default/files/Sign_Language.pdf>

Sacks, O , , 1989.. Seeing Voices University of California Press, Paperback published by Harper/Collins

Goldin-Meadow, S. (2003). The resilience of language: What gesture creation in deaf children can tell us about how all children learn language. NY: Psychology Press.

Sandler, Wendy and Diane Lillo-Martin. 2006. Sign language and linguistic universals. New York: Cambridge University Press

Australian sign language: An introduction ,2007, Cambridge University press, Jhonston T. Schemberi A.

National Institute on Deafness and Other Communication Disorders.2019 <https://www.nidcd.nih.gov/health/american-sign-language>