Local Sign Language to Text and Speech Conversion using Machine Learning and Image Processing

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INTRODUCTION

- Research Problem.
- Research Gap.
- Research Questions.
- Solution.
- Benefits.

RESEARCH PROBLEM

- Deaf and Dumb Community of Sri Lanka…

> **"Rights of the deaf community to express their views and opinions are severely violated because of severe communication constraints faced by them" – *UN Report on Persons with disabilities in Sri Lanka (2017)***
>
> **"…almost all people in the country were unaware to interpret or communicate in sign language. – *DailyMirror.lk***

- No proper communication
- Community corners them

RESEARCH GAP

- Not using mobile phones for communication.
- Global Sign Languages
  - No robust app for local sign languages
  - Local Sign Languages...

RESEARCH QUESTIONS

- How an input will be taken into the system so that it can be processed?
- How an input can be processed?
- How the processed input then be translated?
- Is there any interactive way to provide an output?

PROPOSED SOLUTION

AND ITS BENEFITS

- A Web Application…
- What it does..?
- Future Developments…

Data Acquisition using Image Processing

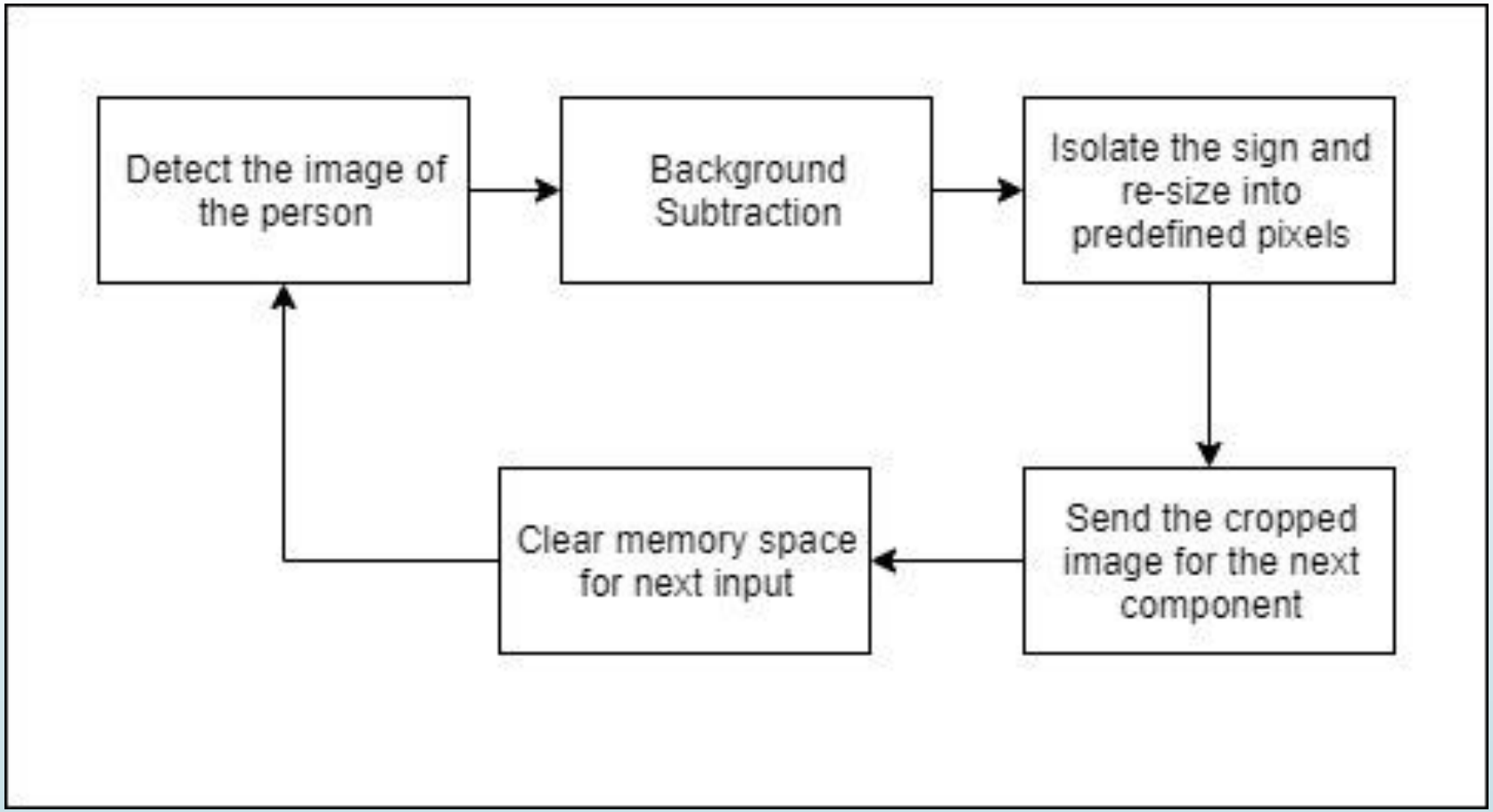
RESEARCH PROBLEM

How the system get the sign as the input?

OBJECTIVES

- **To get a cropped image…**
  - *To get the photo of full-body as camera input*
  - *To identify the hand gestures*
  - *To reduce unnecessary background spaces*
  - *To crop out the sign*
  - *To re-align the image into a predefined size*

METHODOLOGY



TECHNOLOGIES

AND ALGORITHMS

✓**Blob Analysis technique**

- To resize the cropped image of the sign into the pre-defined pixels

REQUIREMENTS

AND BUDGET

- **Functional Requirements**
  - Detect Both hands…
- **User Requirements**
  - Real Time…
- **Budget…**

EXPECTED OUTCOME

Finally the system should be able to,

Detect an image of the body and crop out if there is a gesture is being presented. Such cropped out image should be passed on to the next component

Feature Extraction & Filtration using Image Processing

RESEARCH PROBLEM

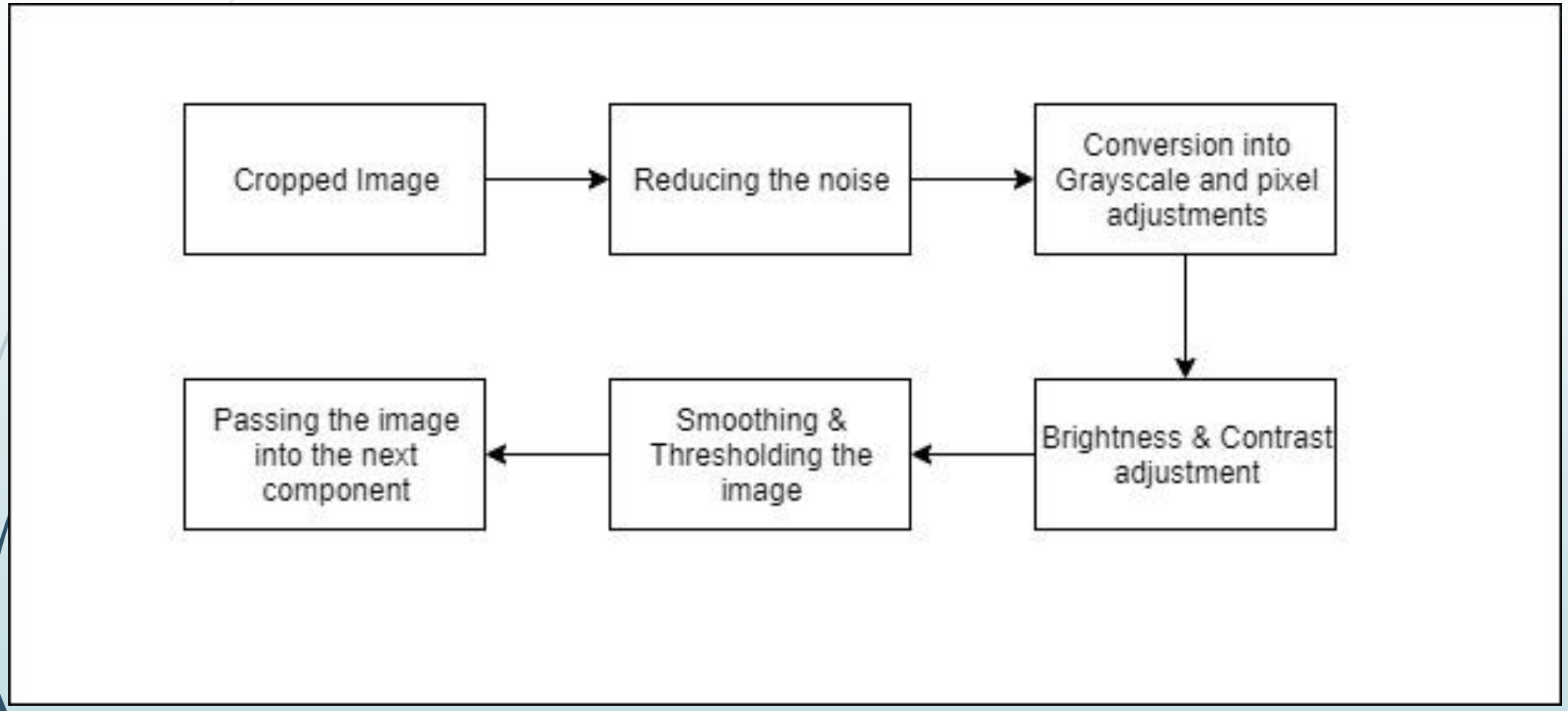
How to get a clear, identifiable, filtered image out from the cropped hand gesture image?

OBJECTIVES

- **To identify a filtered, clear image through the cropped sign gesture**

- *To reduce the noice in the image*
- *To convert the original image into grayscale image*
- *To balance the brightness & the contrast of the image*
- *To smooth & threshold the cropped image before it pass to the next component*

METHODOLOGY



TECHNOLOGIES

AND ALGORITHMS

✓**Gaussian Filter**

- To get a blur image in order to reduce the noice in cropped image

REQUIREMENTS

AND BUDGET

- **Functional Requirements**

1. System should filter all the images with sign gesture without complexing the order they get in to the system

2. After applying feature extraction & filtration techniques, the size of the image should not be changed

3. After every successful extraction & filtration all images should pass to the next stage without changing the order

REQUIREMENTS AND BUDGET

- **User Requirements**

  1. Feature extraction & filtration should happen in real time

EXPECTED OUTCOME

Finally the system should be able to pass,

a clearly extracted, filtered & grayscale converted image of the cropped hand gesture to the next step (Sign Recognition & Translation)

Sign Recognition and Translation using Machine Learning

How to translate sign images into letters in real time?

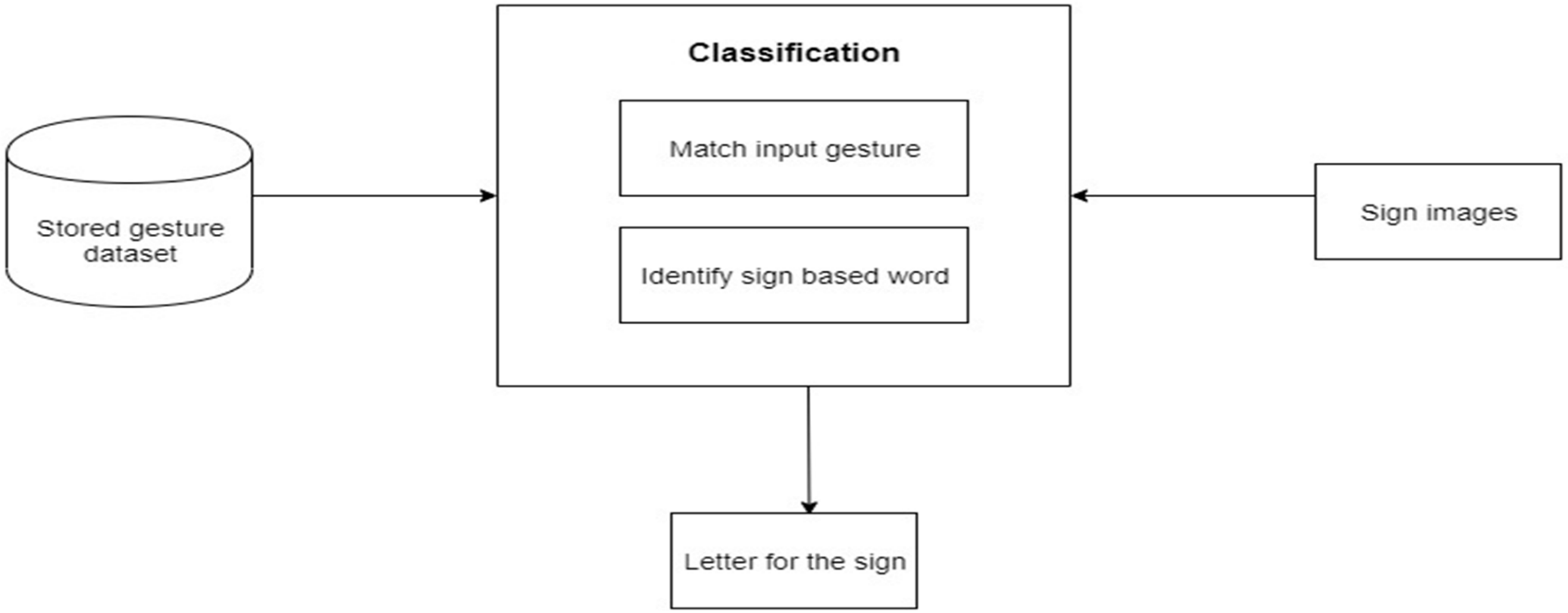
- As our project is a real time responsive system, we have to translate the images in a short time.
- No sensors or external cameras. Only low-resolution cameras.

Research	Capturing device
A Chinese Sign Language Recognition System [3]	Leap motion controller
American Sign Language Recognition using Deep Learning and Computer Vision [4]	External HD camera
Gesture Recognition Using Kinect for Sign Language Translation [5]	Kinect sensor

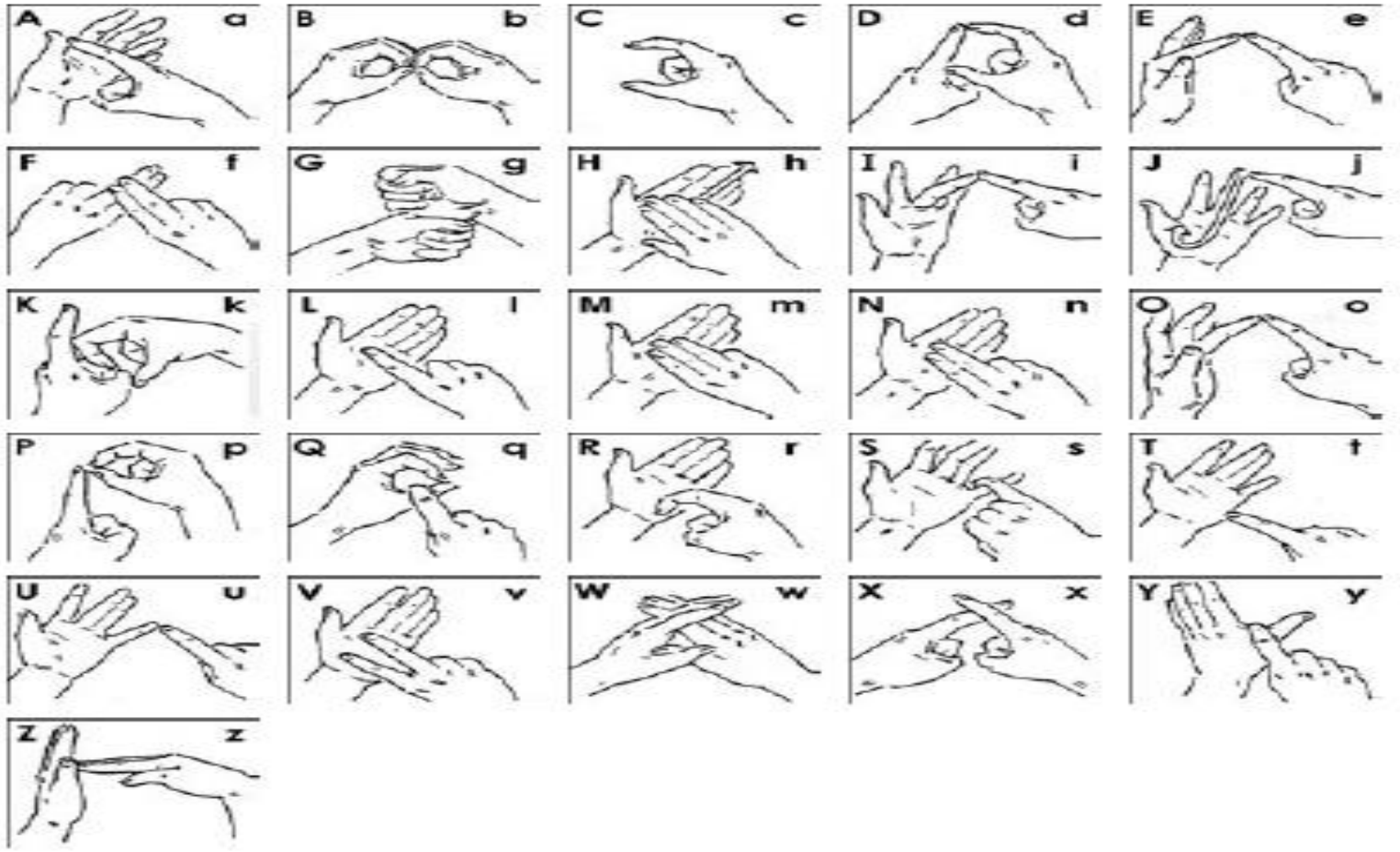
OBJECTIVES

- Capturing and feeding image datasets(20 images per sign).
- Training the dataset.
- Writing machine learning algorithms to detect signs.
- Translating the signs into letter.

System diagram



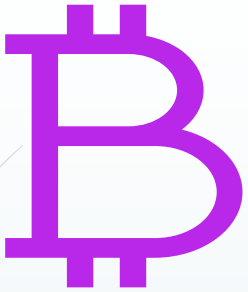
Srilankan English Sign Language



TECHNOLOGIES

REQUIREMENTS

- **Functional requirements**
  - Image data set for SSL (20*26 = 520 images).
  - Translation engine using ML algorithms.
- **User requirements**
  - Translation should happen in real time.



Budget

2GB of data space in MongoDB – 2000LKR (9$).

Expected outcome

Each signs will be converted into letters.

Text and Voice assistance for local languages

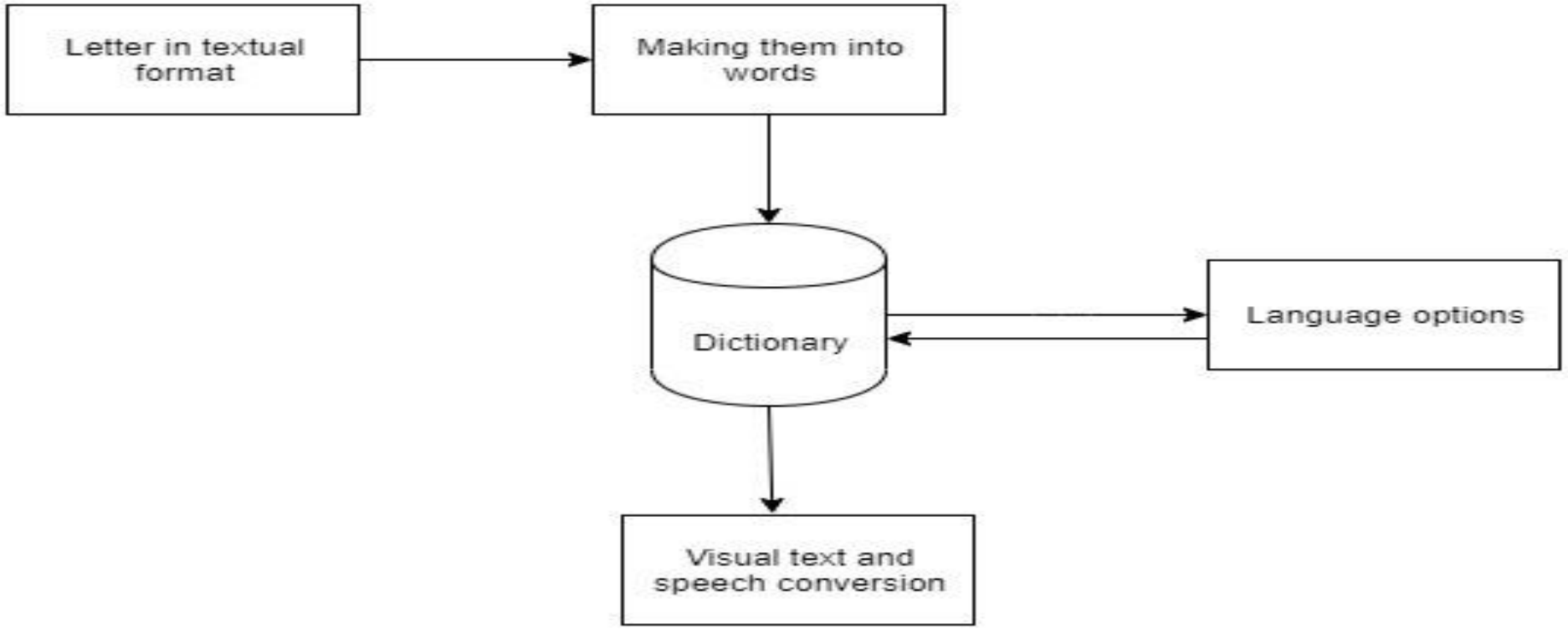
RESEARCH QUESTION

How to build a robust text and voice translator?

OBJECTIVES

- **Letters in textual format**
- **To translate text to text local languages**
- **To Translate text to speech local languages**

METHODOLOGY



TECHNOLOGIES

Python

SAPI

REQUIREMENTS

Functional Requirements

- Translation engine using ML algorithms
- Letters should convert into words
- SAPI should be integrated

User Requirements

- Translation should happen in real time.
- User can select their language their own language (Sinhala, Tamil, English)

Expected outcome

Sign will be translated into respective languages with text and audio format

REFERENCES

[1] UN Universal Periodic Review - Sri Lanka 2017

[2] http://www.dailymirror.lk/120267/Disability-Is-Not-Inability

[3] A Chinese Sign Language Recognition System by Yaofeng Xue, Shang Gao, Huali Sun, Wei Qin

[4] American Sign Language Recognition using DeepLearning and Computer Vision by Kshitij Bantupalli, Ying Xie

[5] Gesture Recognition Using Kinect for Sign Language Translation by Harsh Vardhan Verma, Eshan Aggarwal, Satish Chandra

QUESTIONS??