Progress Review - 02

Sinhala Dialogue Management Tool to Screen Kids with Autism Spectrum Disorder

Project ID: 2021-006

Our Team

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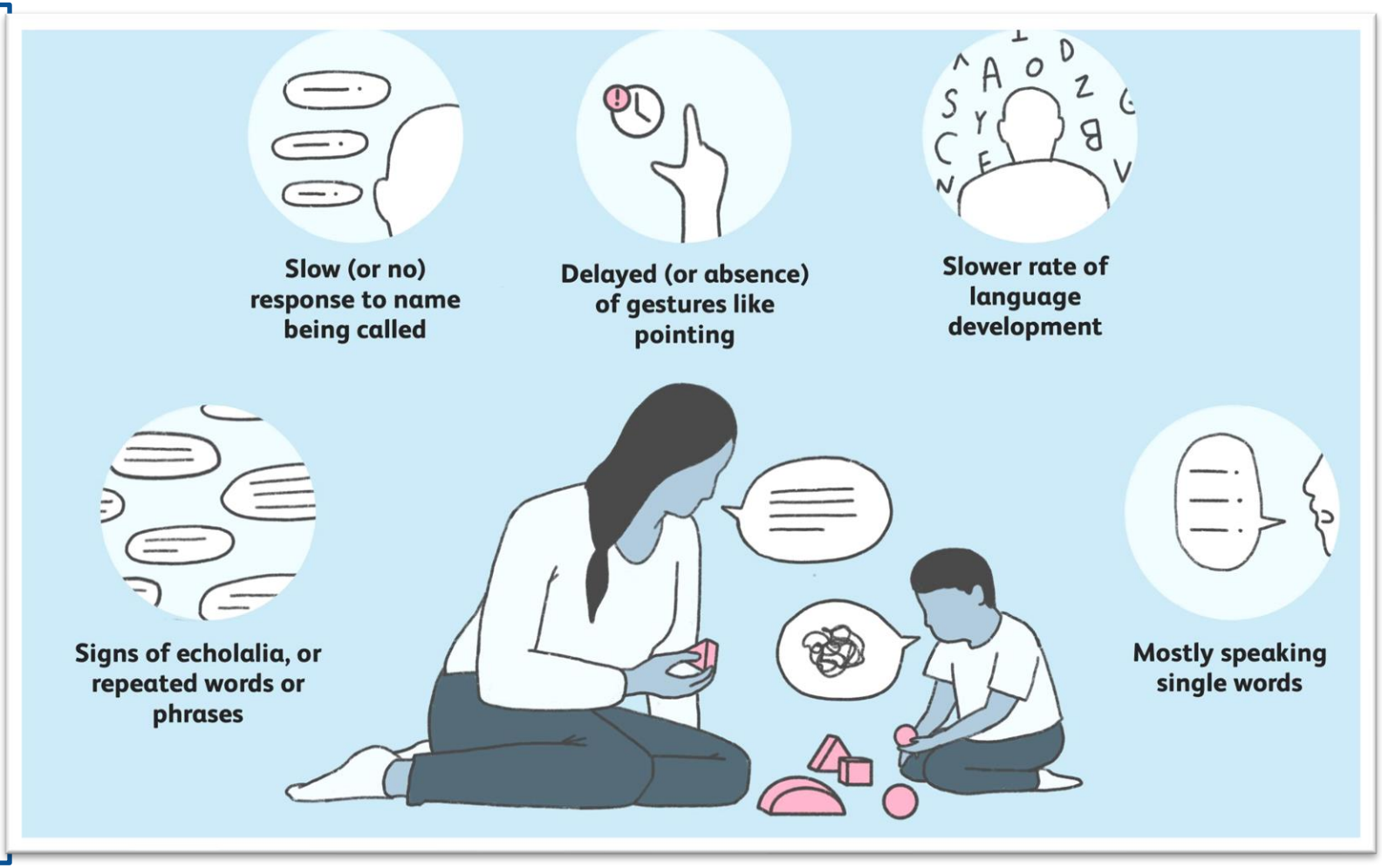
Introduction

- Autism spectrum disorder (ASD) is a developmental disability that can cause significant social, communication and behavioral challenges.
- In the past few years there hasn't been a proper way of identifying Autistic children in Sri Lanka.
- Early identification and diagnosis are important to improve the clinical outcomes of the individuals with ASD. (6 months to 4 years of age- Early language development age)

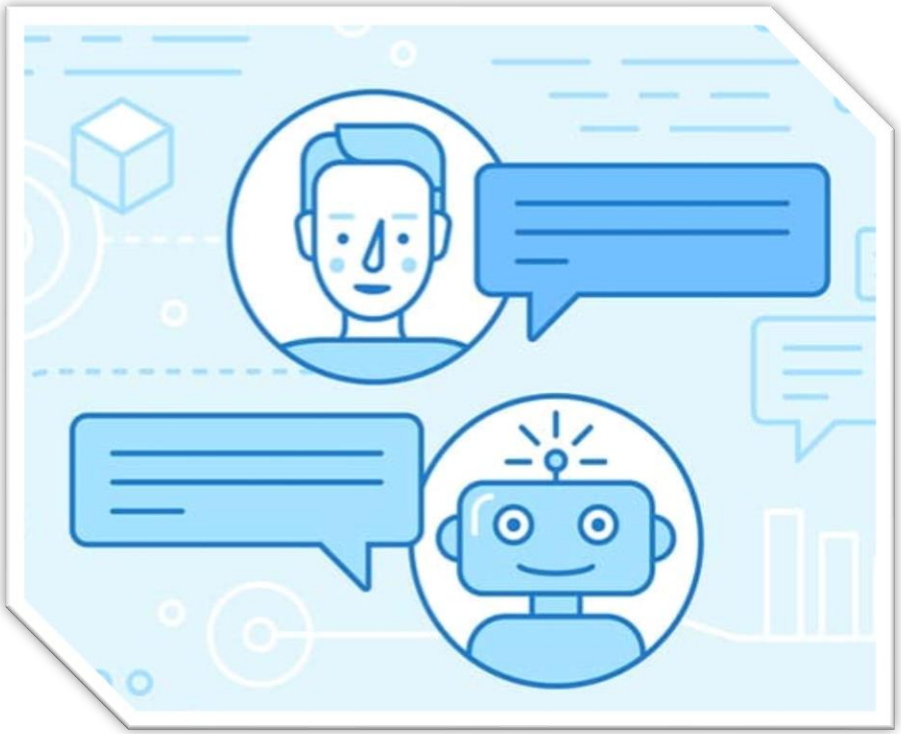


Research Question

In Sri Lanka

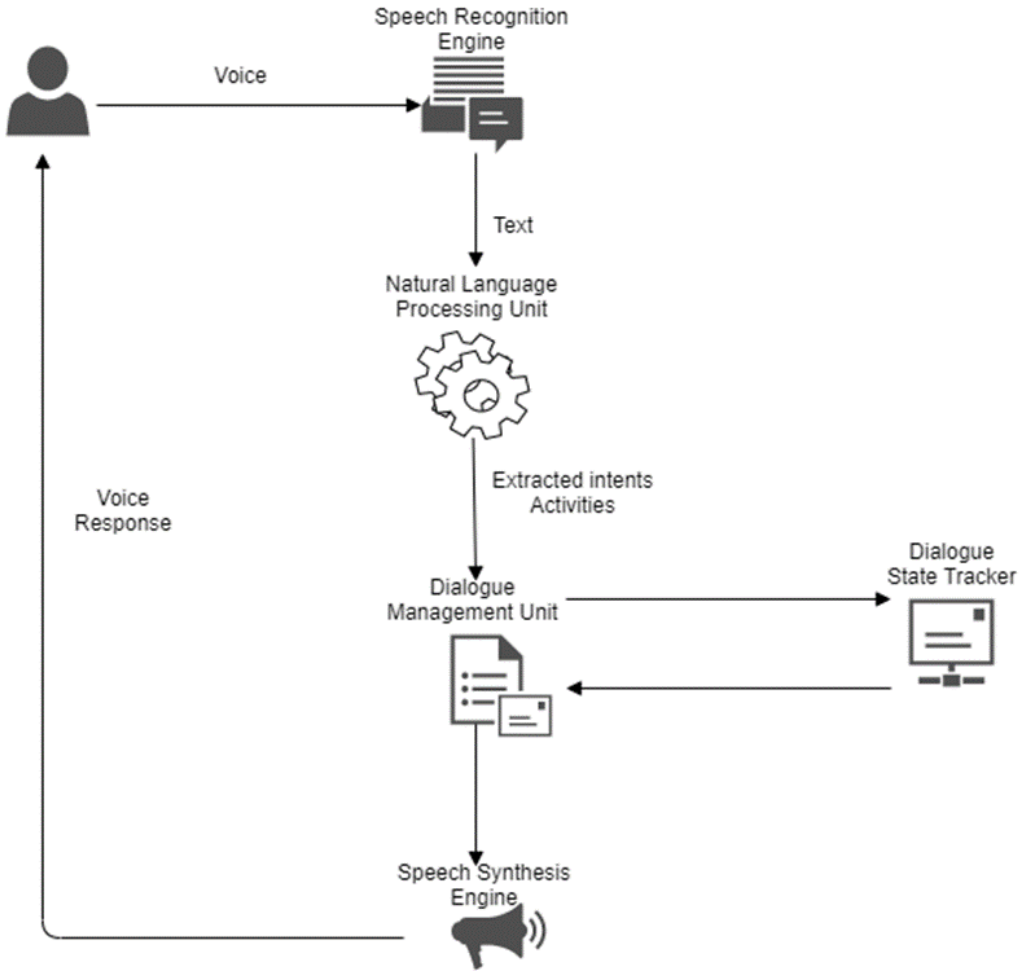
- Approximately 1 in 93 (1.07%) of the children has ASD.
- The general awareness and understanding is lack regarding autistic kids.
- In Sri Lanka, a mandatory culturally sensitive and specific screening of infants and children is limited to the large hospitals in Colombo and other urban areas.
- Parents of autistic children are often left alone with their issues and do not have access to adequate support and knowledge about their child's condition.
- Any intervention or treatment related to autism is more effective the earlier it starts and the more consistent it is applied.[4]

Proposed Solution



ASD.AI is a machine learning-based automated autism screening tool which gives a solution to reduce or eliminate error-prone, inefficient human intervention in the field, unavailability of support for the Sinhala language, unease integration with existing applications, and inability to train using previous data.

System Diagram of Proposed Solution



Work Breakdown Structure

DIALOGUE MANAGEMENT COMPONENT

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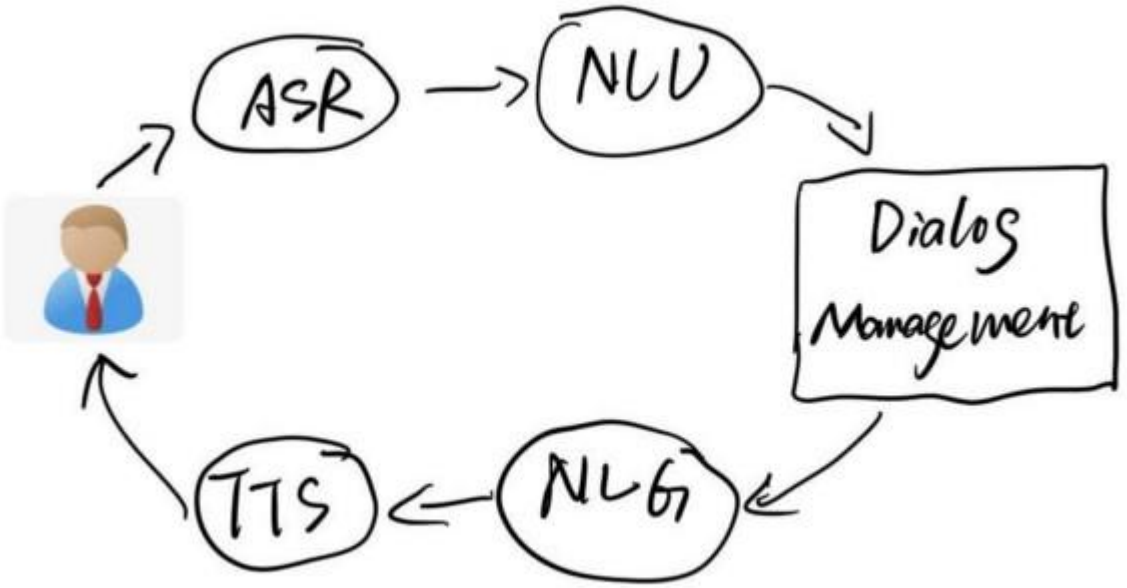
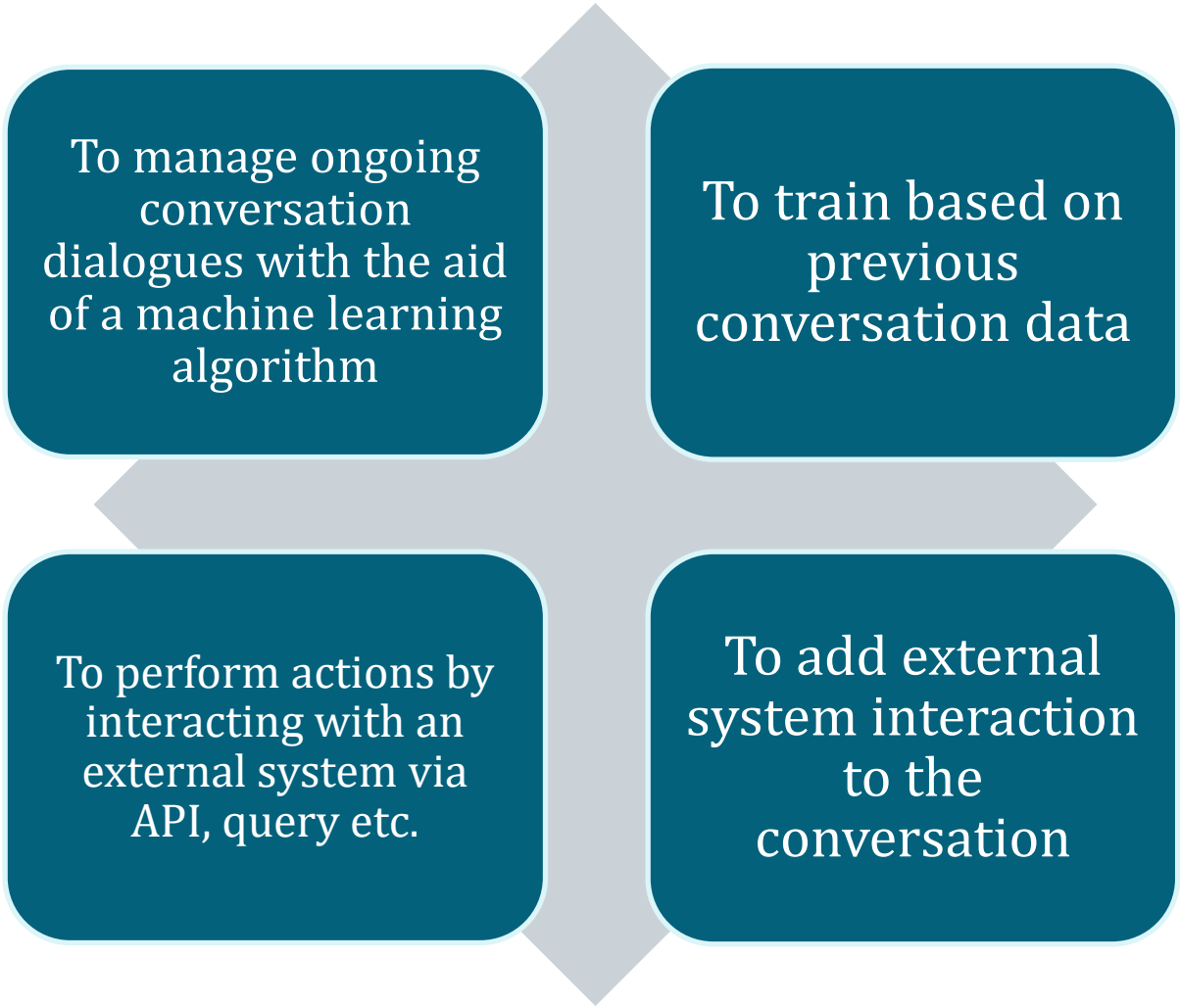


Research Question

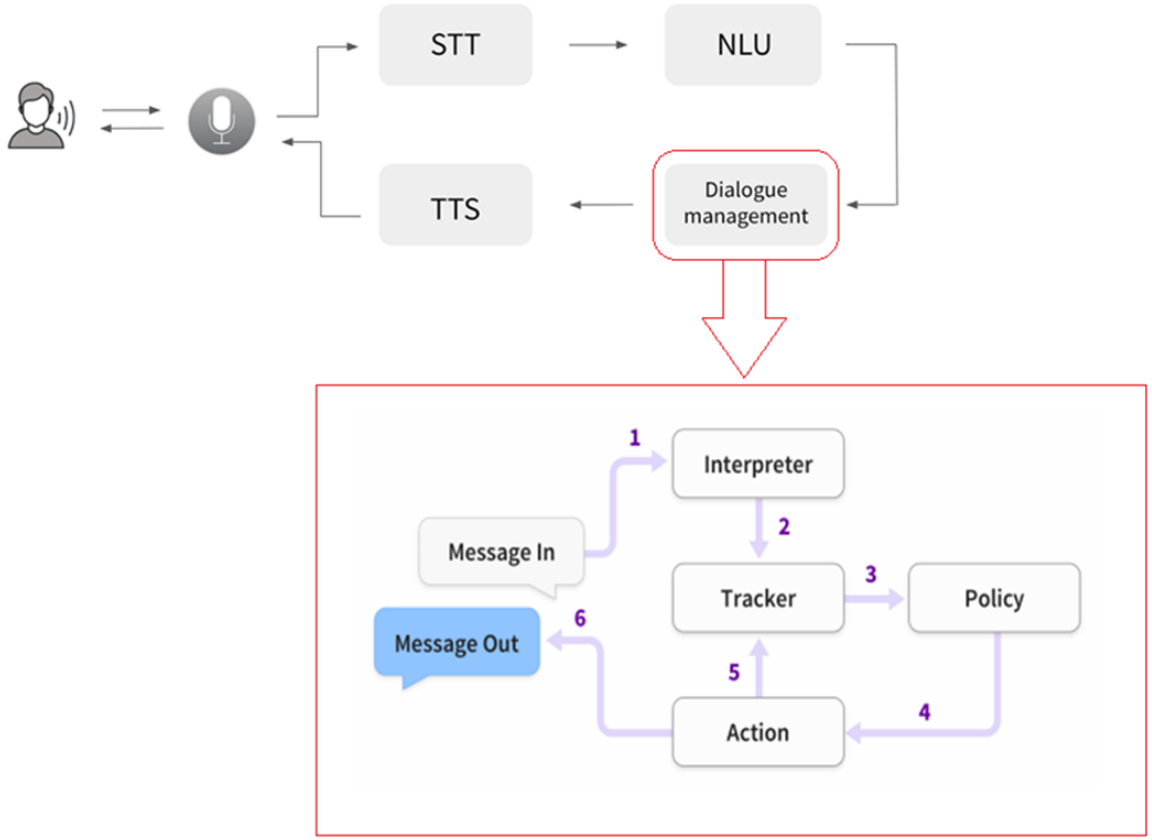
There are currently no population-based screening programs for autism in Sri Lanka, and autism screening is not a mandatory part of primary health care.

There are over 5000 languages in the world, but the thing is, there are only a few languages in the world that are very common and most used. Most chatbots use English as the primary language due to its usage .

Objectives


To manage ongoing conversation dialogues with the aid of a machine learning algorithm
To train based on previous conversation data
To perform actions by interacting with an external system via API, query etc.
To add external system interaction to the conversation

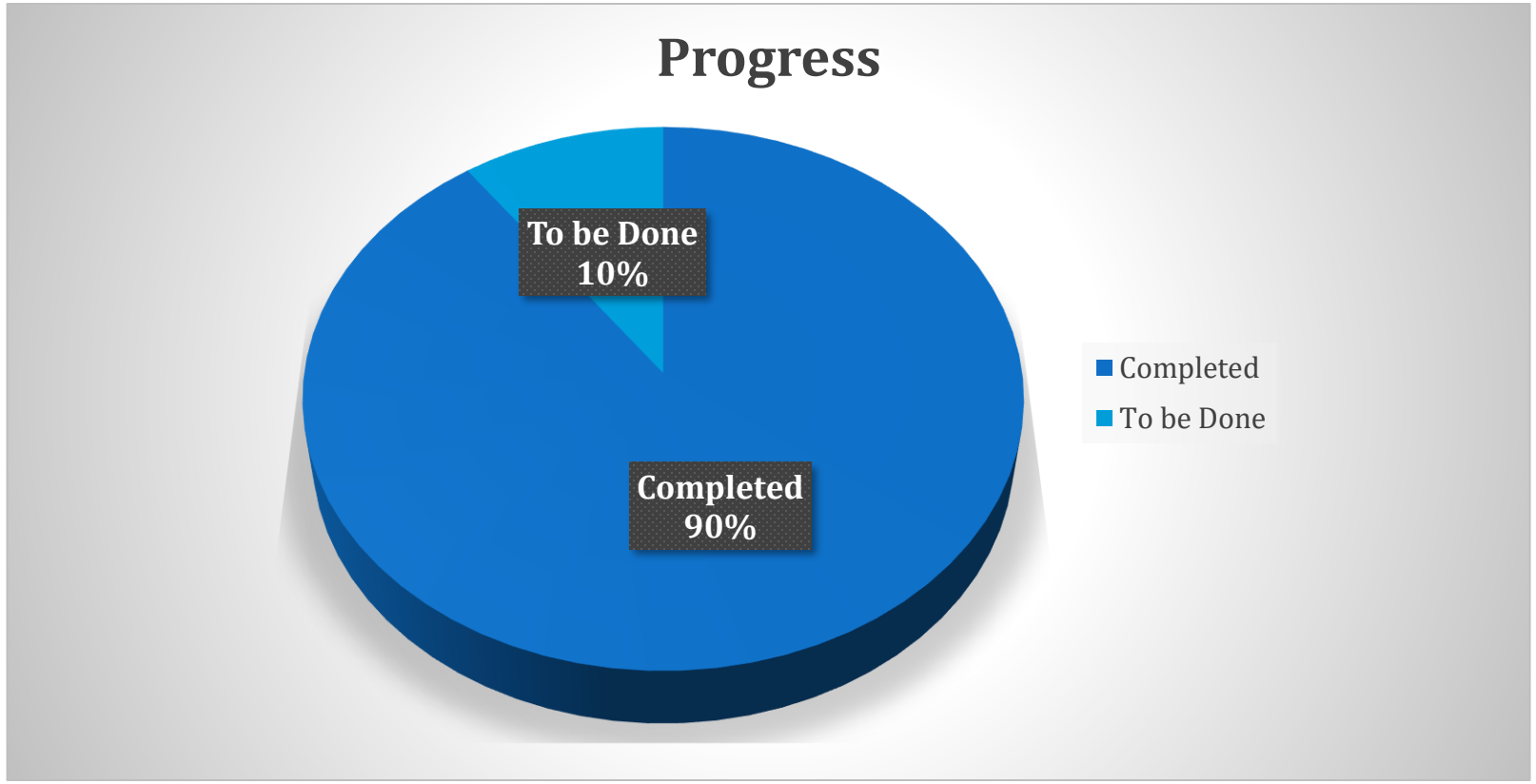
System Diagram



Methodology

- Rasa Core predicts which action to take from a predefined list.
- An action can be a simple utterance, i.e., sending a message to the user, or it can be an arbitrary function to execute.
- When an action is executed, it is passed a tracker instance, and so can make use of any relevant information collected over the history of the dialogue: slots, previous utterances, and the results of previous actions.
- Actions cannot directly mutate the tracker, but when executed may return a list of events.
- The tracker consumes these events to update its state.
- There are a number of different event types, such as SlotSet, AllSlotsReset, Restarted, etc.

Progress at the Moment



Progress Status

Completed	Further Improvements
• Implementation of a dialogue management system to effectively manage the conversations between kids and the system for a specific domain of concern (e.g., Kid's preferences) in English language. • Improving the system for it to suit the domain of screening kids with autism disorder and the Sinhala language.	

SINHALA SPEECH RECOGNITION COMPONENT

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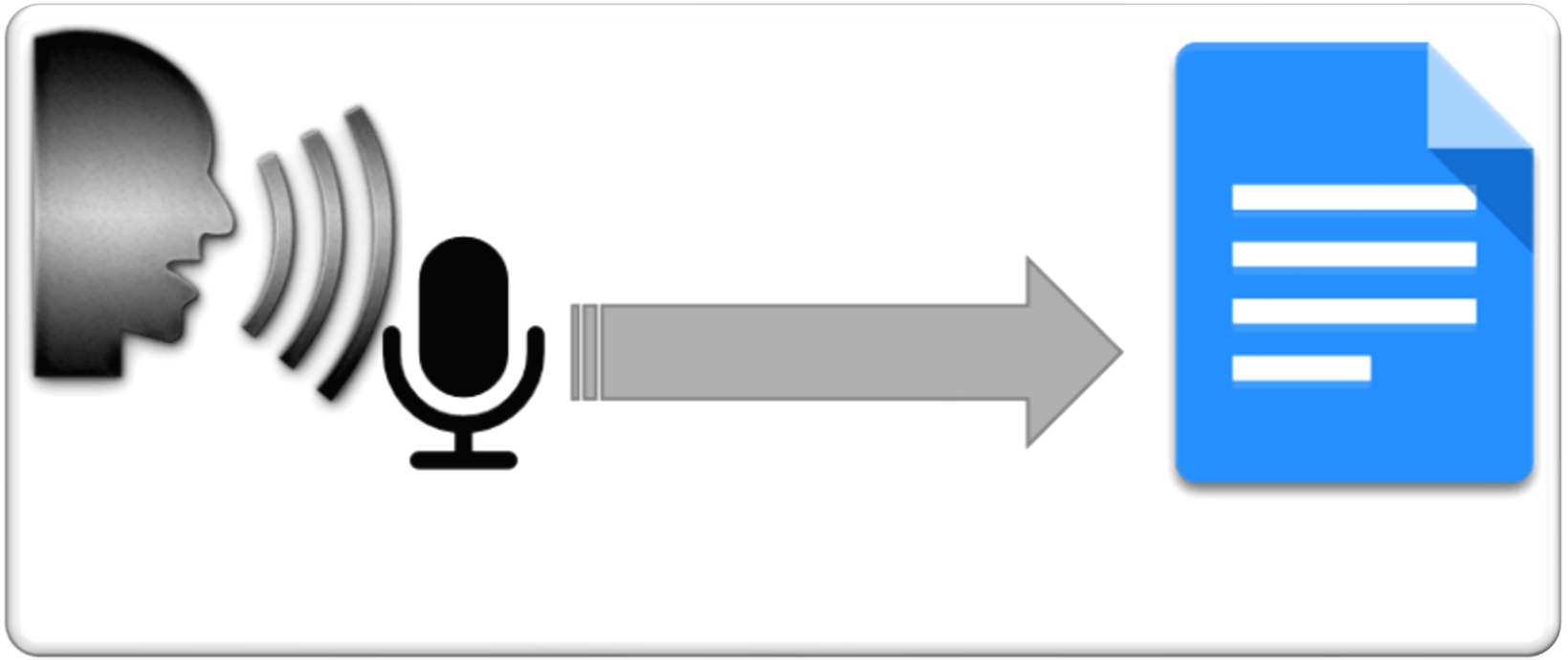


Research Question

Although many of these platforms support languages around the world, we have yet to find a single platform that supports Sinhala

Basic vocabulary for speech recognition: To present a large list of words that the system can identify

Words: Finding ways to distinguish a word under different words.

Accuracy: To get the ability of a system to recognize a word correctly. So find ways to recognize speech to get better text.

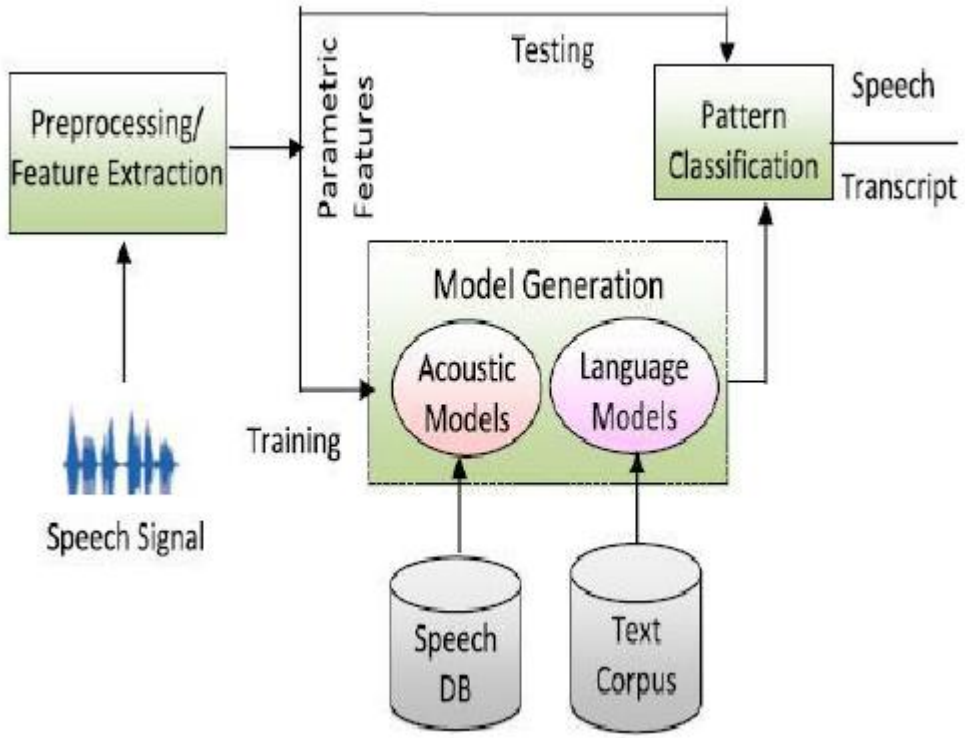
Objectives

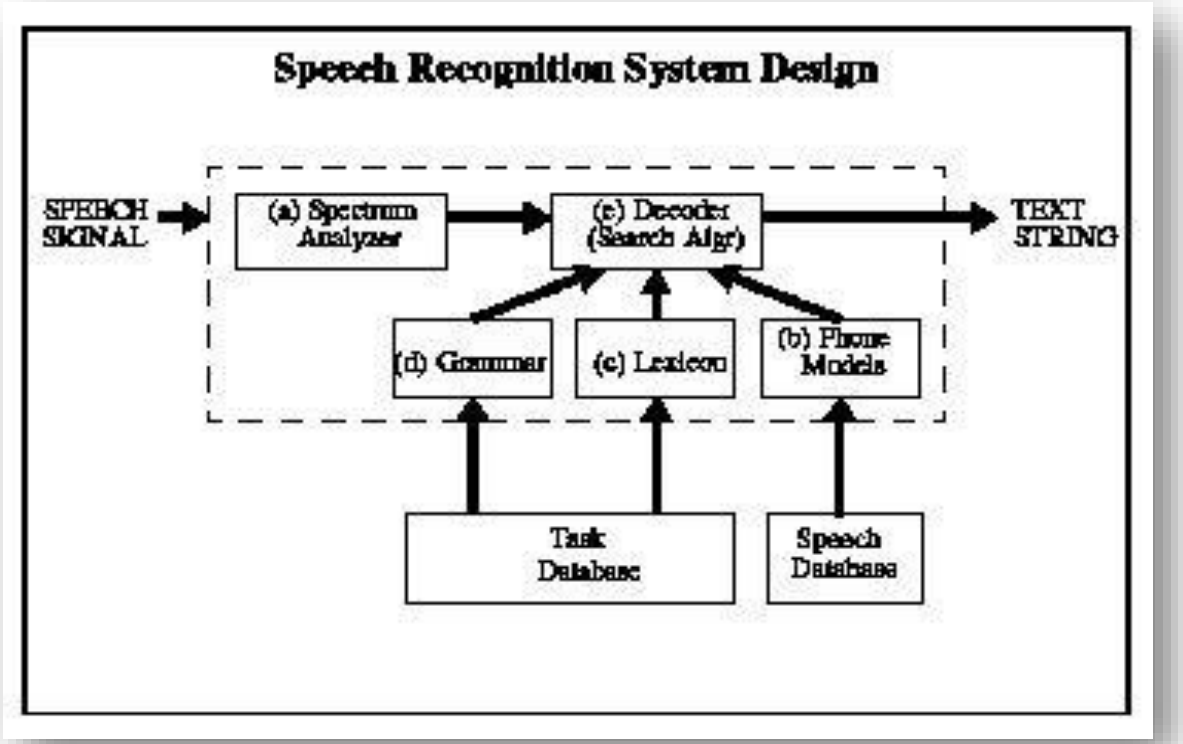
Find a way to distinguish between specific sound waves from the host according to the background noise.

If the same word can be pronounced differently, the spelling and phonology of the same word will change and the software will find a way to recognize it correctly.

Design a number of words that the system can identify and find a way to identify a large number of words that are used on a daily basis beyond those language boundaries.

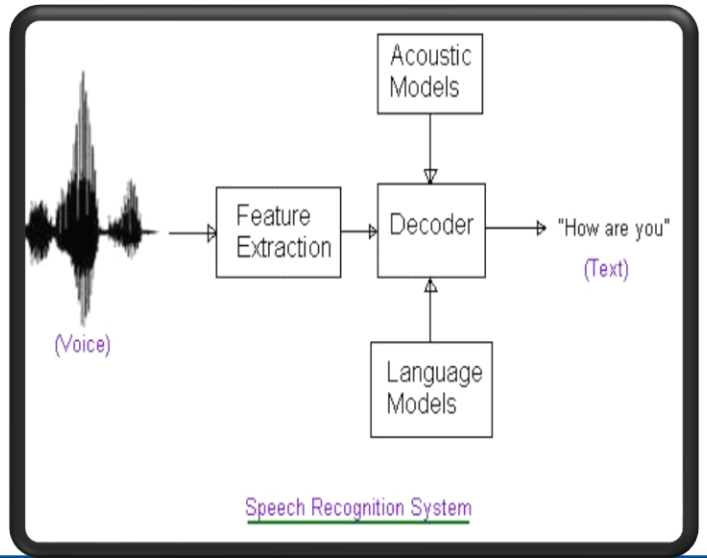
System Diagram



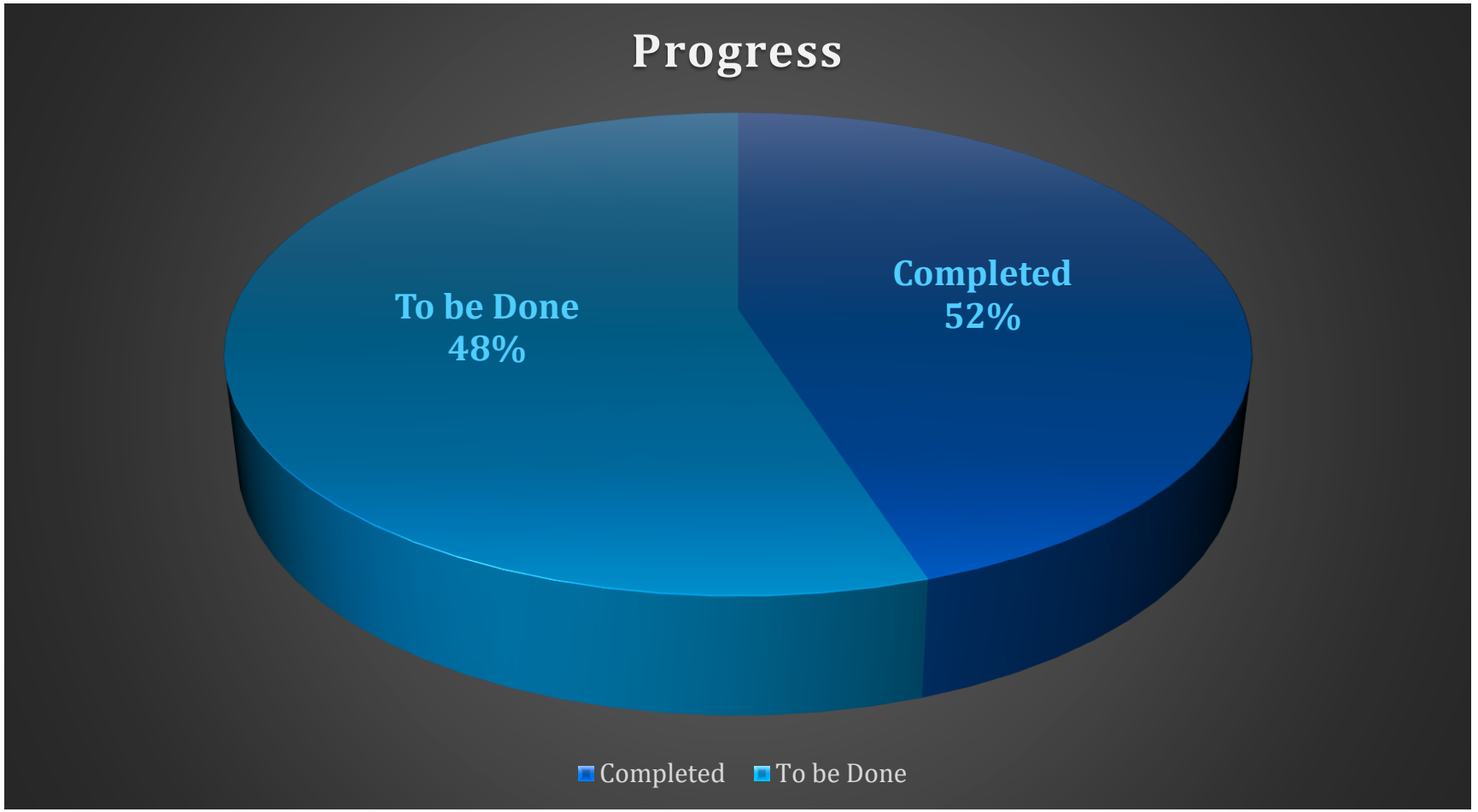


Methodology

- This can be viewed as an inverse operation for speech synthesis system. The kids' voices will be input into the system.
- The Speech recognition unit should be the first to get the input voice and convert it to a text transcript for Natural language processing unit input.
- System should be able to get the voice from the user in a trained language.
- Digital sampling of the input speech in a trained language..
- Spectral analysis of digitized speech input recognize words and utterances
- Convert speech into text and store as text transcripts.



Progress at the Moment



Progress Status

Completed	Further Improvements
The speech to text conversion module is made using the Speech Recognition python library and is implemented on Google Colab . First, it will be tested for mp3 audio file.	This module will be implemented for audio taken from a microphone. and for the Sinhalese language so that real-time Speech to text Conversion is possible for voice data.

Demonstration of Sinhala Speech Recognition Component

MOA STATE-OF-THE-ART NEURAL SPEECH SYNTHESIS SYSTEM

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ASD.AI

Research Question

There are many TTS systems exist for many languages. Most of them are developed to cater with English language and not in Sinhala language.

There is a general lack of awareness among Sri Lankan society regarding kids with ASD.

The existing voice synthesizers are not consisted of every verbal language on earth.

Objectives

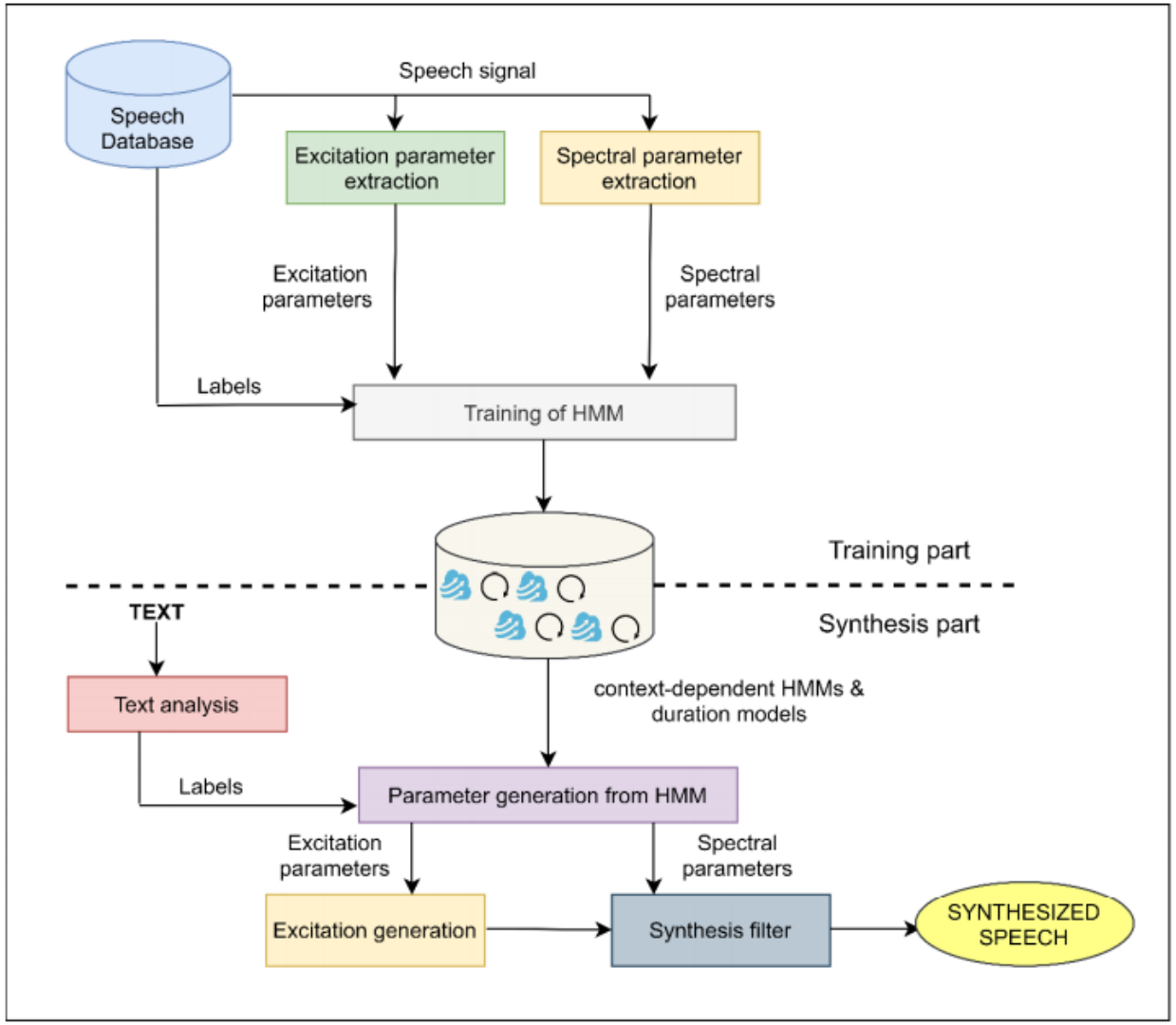
To develop a fully featured complete Sinhala Text to Speech system that gives a speech output similar to human voice while preserving the native prosodic characteristics in Sinhala language.

To develop a TTS system with the ability to maintain a real-time conversation with Autistic kids.

To develop a TTS system to pronounce the given text with proper rhythm, melody.

To find correct pronunciation, for different contexts in the text and to find correct intonation, stress, and duration from the text.

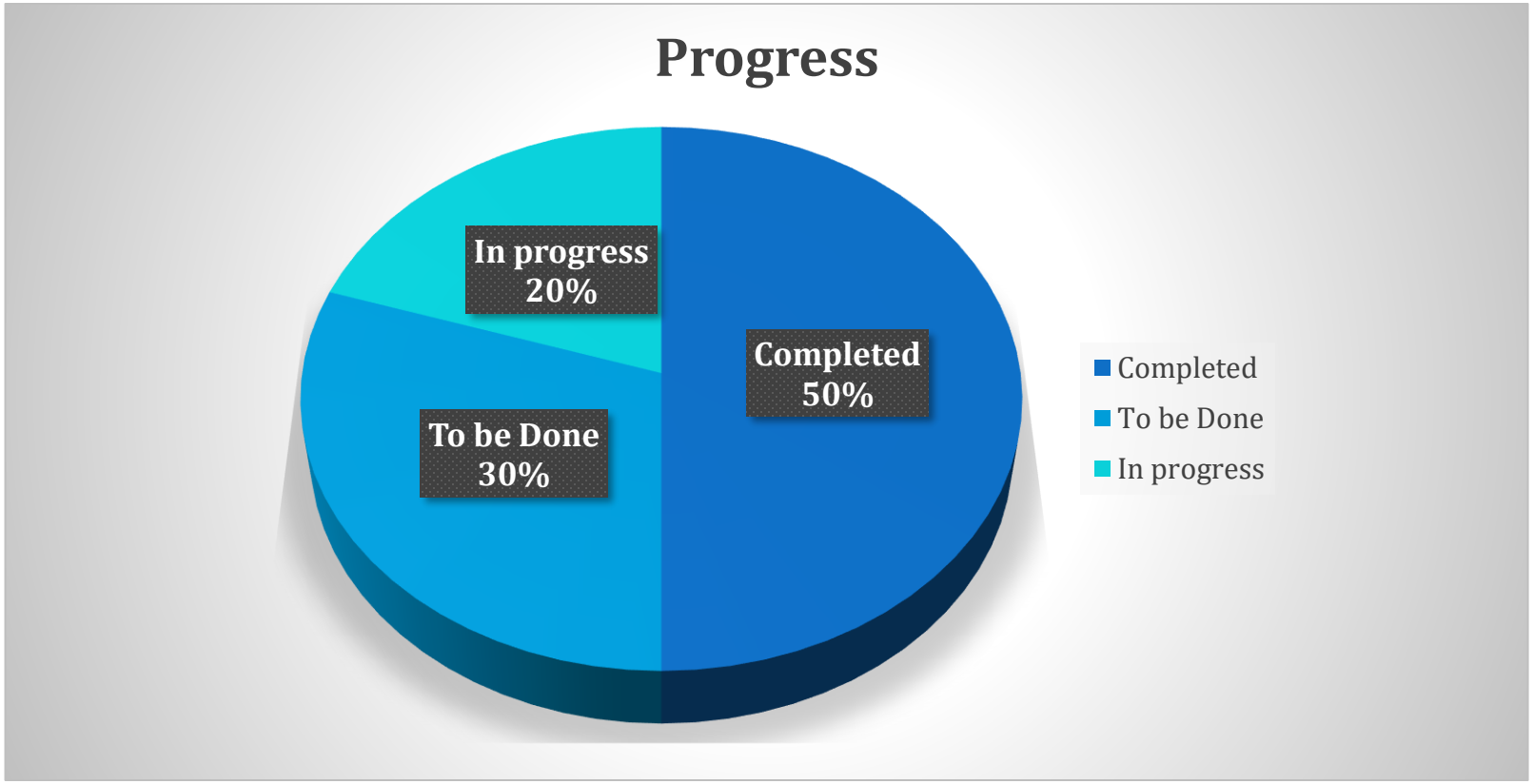
System Diagram



Methodology

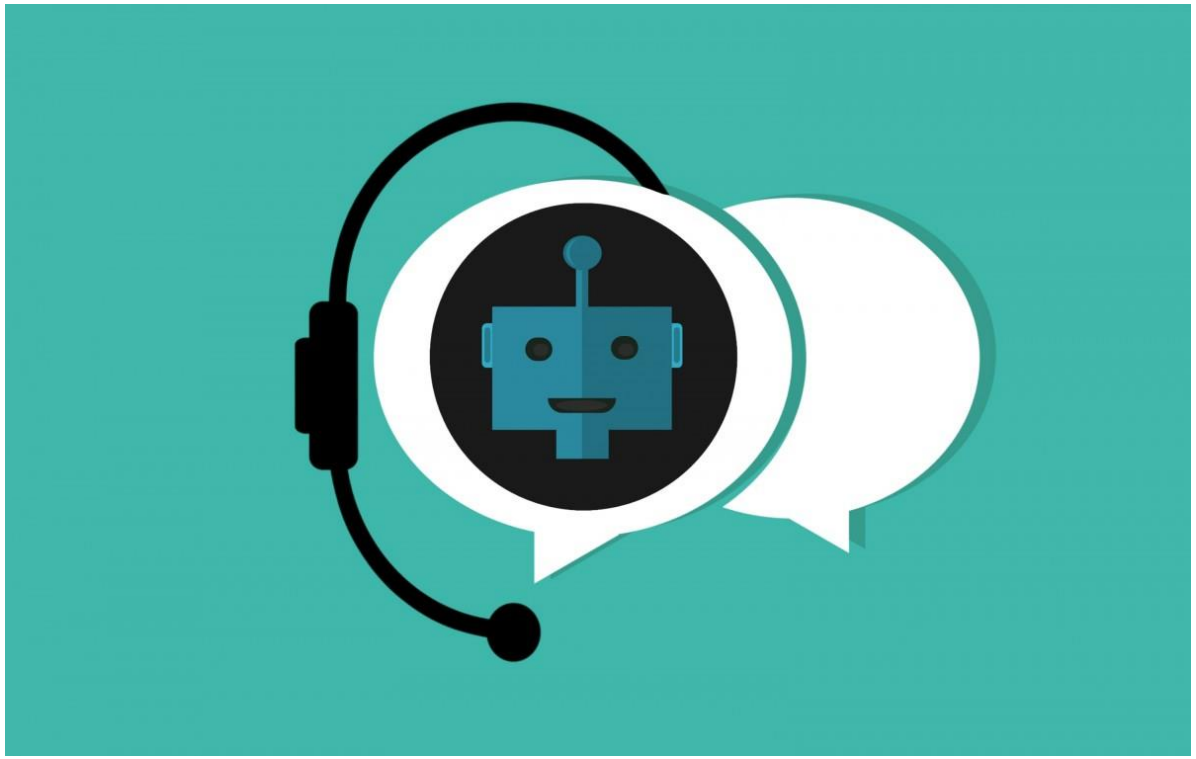
- The system has mainly two parts; Training part and Synthesis part
- There is a speech database in training part which is used to excitation parameter extraction and spectral parameter extraction.
- After that model will be trained with HMM.
- In the synthesis part there are context dependent HMMs & duration models.
- The given text will be analyzed first and generated the parameter from HMM.
- Then the synthesized speech will be created using the generated excitation parameters and spectral parameters.

Progress at the Moment



Progress Status

Completed	Further Improvements
• Completed implementing Deep Voice 3 and Wave NET implementation in English language.	• Implementation of this system for Sinhala language.



Demonstration of Sinhala Speech Synthesis Component

Natural Language Processing Component

IT18081794
HERATH H.M.D.N

Research Question

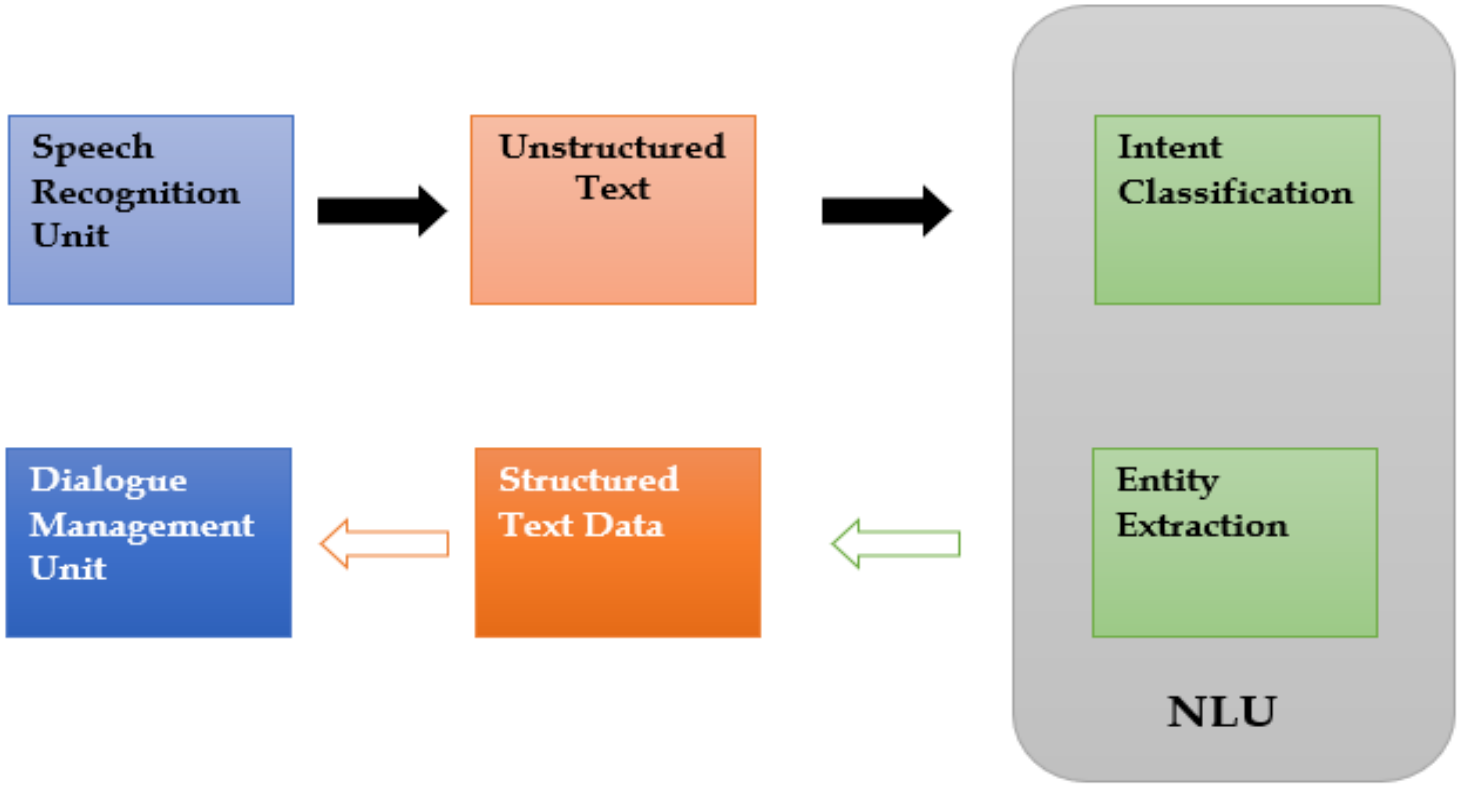
- Lack of customized NLU tools with Sinhala language support in healthcare industry to use as a component to develop a Machine Learning based automated autism screening tool

- Lack of Sinhala corpora to customize existing NLU tools

Objectives

- **Develop a customized NLU tool with Sinhala language support as a component of Machine Learning based automated autism screening tool**
- Support both English and Sinhala languages
- Reduce or eliminate error-prone, inefficient human intervention
- Efficient and robust performance
- Increase availability
- Simultaneous user access
- Cost effectiveness
- Increase overall quality and the productivity of the service

Individual System Diagram

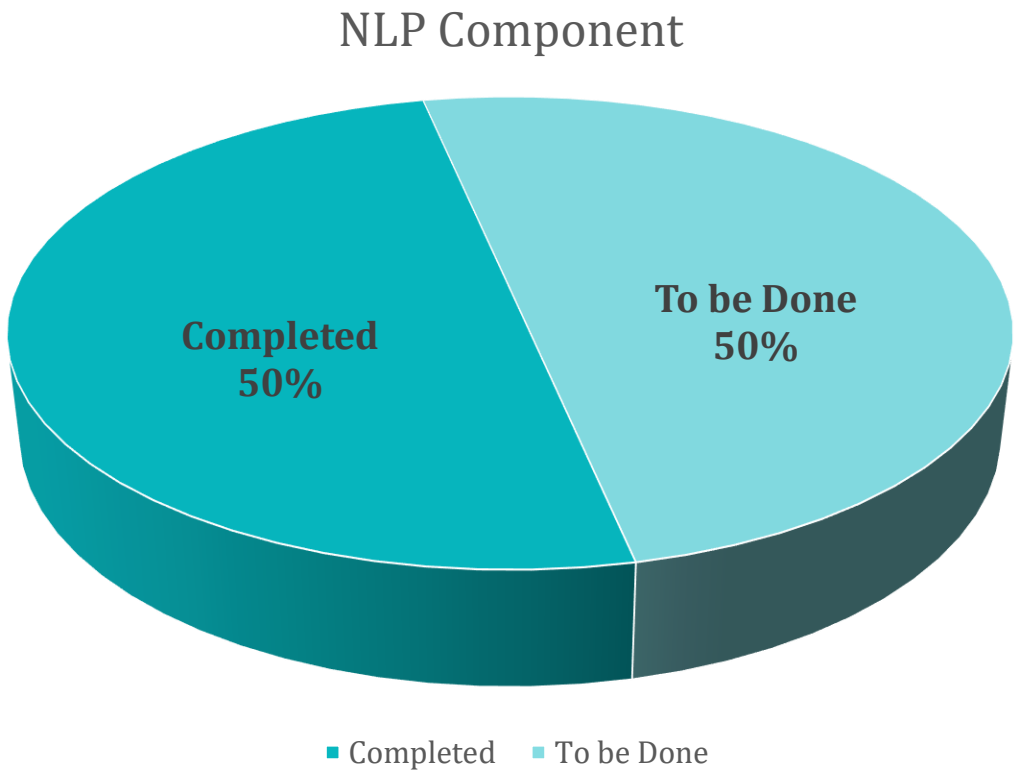


Methodology

- Why RASA NLU?

  - Supervised learning model
  - Customizability with other languages
  - Ensures the privacy of datasets
  - Ability to plug in pre-trained models for unique datasets
  - Ability to handle multiple intents in a single message
  - Out-of-the-box model testing capabilities to be more accurate over time

Progress at the Moment



Progress Status

Developed an NLP chat-bot system to have conversations with kids to find their preferences. A prototype model is tested, and it will be converted to a chat-bot system to analyse each text received from speech recognition.

Implementation will be further enhanced to Sinhala language.

RESEARCH POSTER

DEMONSTRATION

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THANK YOU!