

**ASD.AI: A TOOL TO SCREEN KIDS WITH
AUTISM SPECTRUM DISORDER [2021-006]**

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October 2021

DECLARATION

I declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.



2021/10/13

Signature (Anjali R.P.D.N)

Date

The on top of candidate has distributed analysis for the bachelor's degree treatise below my superintendence.

Signature of the Supervisor

Date

Signature of the Co-Supervisor

Date

ABSTRACT

Artificial reconstruction of human repetitive patterns of machine learning allows a computer to diagnose autism without programming. Autism diagnostic tools are very suitable for autistic kids because the primary medium of human communication is speech for literate and ignorant users; this is the best and easiest way to use. It too easily identifies people with autism rather than looking for patients through written methods such as booking.

Focus my part It is speech recognition. It is in translate words correctly into text. (Words, letters) Based on the implementation of Baidu's in-depth stories to support both English and Sinhala .well-known examples are YouTube closed headers, voicemail copying, image systems. It is possible to effectively diagnose children with autism.

ACKNOWLEDGEMENT

Apart from the efforts of the project team, the success of any project rests largely on the concerted endeavors of many others. First, thank Prof. Koiya Pulasinghe for providing for supervising our project.

We also thank our colleagues from the Sri Lanka Institute of Information Technology who have given their invaluable support and comments for our research project to make it a success

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
NLP	Natural Language Processing
AI	Artificial Intelligence
ASD	Autism Spectrum Disorder
RNN	Recurrent Neural Network
GPU	Graphical Processing Unit
DSR	Distributed Speech Recognition
TTS	Text to Speech
LMIC	Low to Middle Income Countries
M-CHAT	Modified Checklist for Autism in Toddlers
ASQ	The Ages and stages Questionnaire
PEDS	Parents' Evaluation of Developmental Status
API	Application Programming Interface
NLU	Natural Language Understanding
STT	Speech to Text
VB	Variation Bayesian

INTRODUCTION

The goal of this analysis is to form a Sinhala dialogue management tool to youngsters with syndrome spectrum disorder.

Literature Review

Increasing classifications and identifications as of center for Disuse management and bar reports together in one hundred fifty kids have ASD within the United States but these days in 2021 it's currently one in sixty eight kids ab initio there was loads of confusion regarding ASDs conditions and causes all the same ASD analysis continues to own new findings ASD

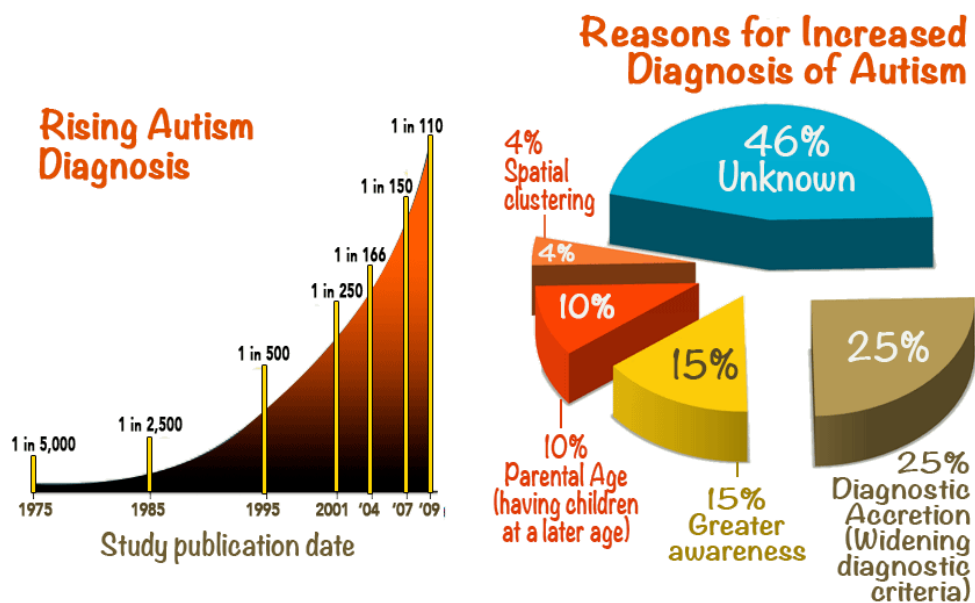


Figure 1: Autism disorder data

Source: Increase of the autism child

Autism spectrum disorder is a range of neuro developmental disorder that involves delays in development of many basic skills and functions, including the ability to socialize and is too common. The condition begins early in childhood and lasts throughout a person's life. It causes problems with functioning in society. Autism spectrum is estimated to affect about 62.2 million globally as of 2015. Males are more often diagnosed than females. Symptoms usually are seen by the age of 2 years. Children with this condition can display a unique pattern of behavior and severity ranging from mild to disabling. People with autism spectrum disorder generally have problems with social communication and interaction, and patterns of behavior. The exact cause of the condition is unknown; the research suggests that genes can act together with influences from the environment to affect a child's development in a way that brings about autism spectrum disorder. Having certain genetic conditions such as Down syndrome, Fragile X syndrome, Rett Syndrome. Extremely preterm babies, Babies born before 26 weeks of gestation may be at greater risk.

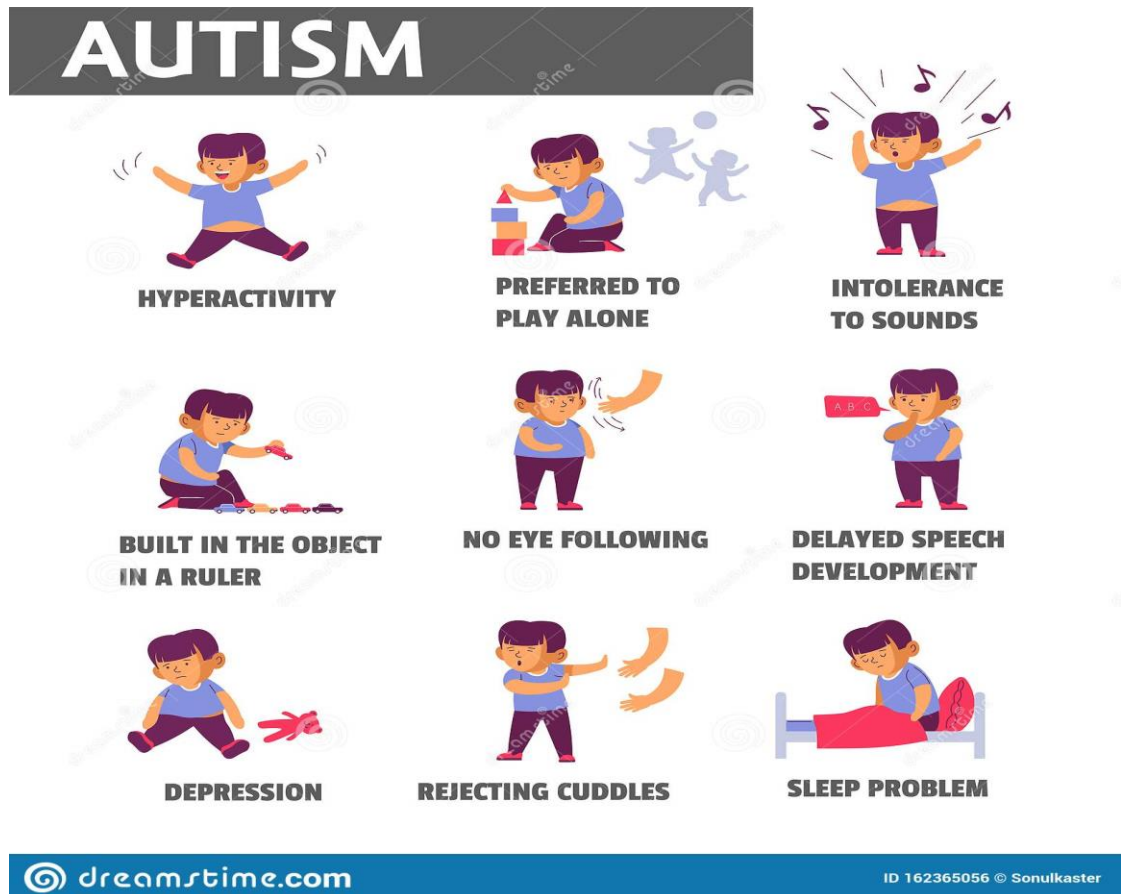


Figure 2: Autism symptoms

Source: Complete Children's Health

There is no specific medical test to diagnose the condition. Recommend genetic testing to identify a genetic disorder such as fragile X syndrome, Down syndrome or Rhetts syndrome. This give the child test that cover Hearing, Speech, Language, Developmental level, Behavioral issues. There are no cure for this disorder but intensive, early treatment can make a big difference in the lives of many children.

The goal of treatment is to improve the ability of the child to function by reducing symptoms and supporting development and learning. Treatment options include Therapy such as Behavioral and communication Therapy, Family Therapy, Speech Therapy, Occupational Therapy. The types of Therapy depends on the child's need.

The core symptoms of Autism cannot be improved with medications, although medications such as antidepressants can help to control anxiety or antipsychotics for severe behavioral problems.

By considering these facts, our research proposal has proposed an autism-screening tool consisting of intelligent artificial agents known as “Voice Bots” to automate the speaking process with the ability to handle operations without human intervention to identify the children with autism by their voice.

The development of artificial intelligence chatbots with traditional text-based interfaces came to the market as a new phenomenon in recent years. However, the main flaw associated with chatbots is the lack of human emotion. Chatbot seems extremely unnatural and semi-problematic due to lack of human emotion. As a solution to this problem, voice-activated chatbots and products came into the market with the popularity of Amazon Alexa, Google Assistant, and Apple Siri as virtual assistants. In addition, the active chatbot frameworks mainly consist of the following research features.

The following components make up most voice-enabled chatbot frameworks.

- Speech Recognition
- Natural Language Processing
- Conversational Artificial Intelligence (Dialogue Management)
- Speech Synthesis

I studied speech recognition for autism because it is my part this research. Researchers have done a number of researches around the above areas to get the best result in speech recognition. Below are some of the important finds we found in the above domains.

➤ . Speech recognition

The main task is to urge a laptop to know oral language. By “understand”, it means that to behave fittingly and convert the input speech into another medium, during this case, text. Speech recognition is thus observed as speech-to-text (STT). even supposing this subject looks to be probed by several researchers currently, it's existed since 1920 once machine ASD.AI - Sinhala Dialogue Management Tool to Screen children with syndrome Spectrum Disorder five recognition was introduced. Since that, engineers and scientists are performing on many methods/patterns, that became advanced from time to time. a number of these square measure,1. Acoustic phonetic based speech recognition

2. Hardware-based recognizer
3. Pattern-based speech recognition
4. Continuous word-based speech recognition
5. Hybrid statistical and connectionist (HMM/ANN) based speech recognition
6. Vibrational Bayesian (VB) estimation-based speech recognition

Some of the ongoing research can be described as below.

According to [9] The Aurora framework, which is developing standards for Distributed Speech Recognition (DSR) where the speech analysis is done in the telecommunication terminal and the recognition at a central location in the telecom network.

The framework is currently being used to evaluate alternative proposals for front-end feature extraction [3]. Furthermore, [10] an empirical comparison among the CTC, RNN-Transducer, and attention-based Seq2Seq models for end-to-end speech recognition has been implied. The outcome would be to emphasize that without any language model, Seq2Seq and RNN-Transducer models both outperform the best-reported CTC models with a language model, on the popular Hub5'00 benchmark.

Well - know examples are YouTube closed headers, voicemail copying.

The primary medium of human communication is speech. For literate and ignorant users, this is the best and easiest way to use it to easily identify people with autism rather than looking for patients through written methods such as book.

Research Gap

A significant amount of research has been carried out in the following research domains like Speech Recognition, Conversational Artificial Intelligence, and Speech Synthesis, which are related to the proposed solution, discussed in this research proposal. Many of the research conducted has enabled the following tasks to be executed from the products, which are like the proposed solution in this paper.

The Advancement of Speech Recognition technologies allowed platforms to support real-time speech recognition with a wide array of different language support. According to the research carried out on each platform, most platforms do not support the speech recognition process. With currently available speech synthesis platforms users are limited to the voices provided by the platform which makes most of them the automated presence to the listener. It was difficult to find a platform with support for training custom voices to provide more naturalistic voice output after the process. Even though most of these platforms support languages across the world, we were yet to find a single platform with support for the Sinhala language.

Basic Vocabulary of Speech Recognition: Introduce an appropriate way to present a list of words that the system can identify. Therefore using a wide range of vocabulary for the system. **Words:** Introduce ways to distinguish a word under different words. **Accuracy:** The ability of a system to recognize a word correctly. Therefore, speech recognition methods are offered to get better text. For example Actual phrase: "He is going to bed," Transcribed Phrase: "He is going to Tibet" (Not Correct)

Research Problem

Day by day, the technology becomes better and better making the life of people easier. However, there are some sides, which are left

With the advancement of technology day by day, human life becomes easier. Cultural knowledge about autism is minimal. Children with autism find it difficult to interpret meaning from their gestures and facial expressions. It is important to recognize autism at an early stage. It is important for autism patients to integrate not only clinical paper but also technology. Will practice snooker network technology using multiple GPU dialogs? This is a successful and easy way to connect with technology.

The main problems with speech recognition are below.

Very difficult for human to do speech recognition, It is difficult because there are several sources of variability, style of speech. Speech recognition was done with read speech versus spontaneous speech it is a lot easier to recognize something that's been read from a script the original database were captured by giving people text and asking them to read it in studio conditions which made those those database easier to recognize vocabulary has increased over time so it used to be that larger vocabulary with a thousand words then it. Now i think the google speech recognition system has a nominal vocabulary of one and a million words. The system has a number of recognizable words and is unable to recognize words beyond that language limit.

In addition, Pronunciation is another problem. Even in English, the pronunciation is different. For example British, India, American People English.

Next problem is Environment. It is background noise, channel conditions, room acoustics, etc. Somebody speaking in the background then that makes it even harder because. Focused initially on speech recognition with closed microphone like a headset. Music or loud noises in the background. Background music and noise affects are accuracy of voice recognition software. Loud sounds drown out the user's voice input. Likewise, music can dupe the software into thinking other words have been said.

Another problem is speaker characteristics. It is rate of speech, accent, etc. Human rate of speech, some people speak faster, some people enunciate more. Child speech is going to be very different from adult speech. so various characteristics of speakers also, which contribute to making a challenging problem. If the same word can be pronounced differently, the spelling and phonology of the same word will change, making it difficult for the software to handle.

Another problem is missing words. If a user speaks louder than the microphone, the software often gets a confusing speech. On the other hand, talking too far away from the microphone leads to missed words.

If a user speaks louder than the microphone, the software often gets a confusing speech. on the other hand, talking too far away from the microphone.

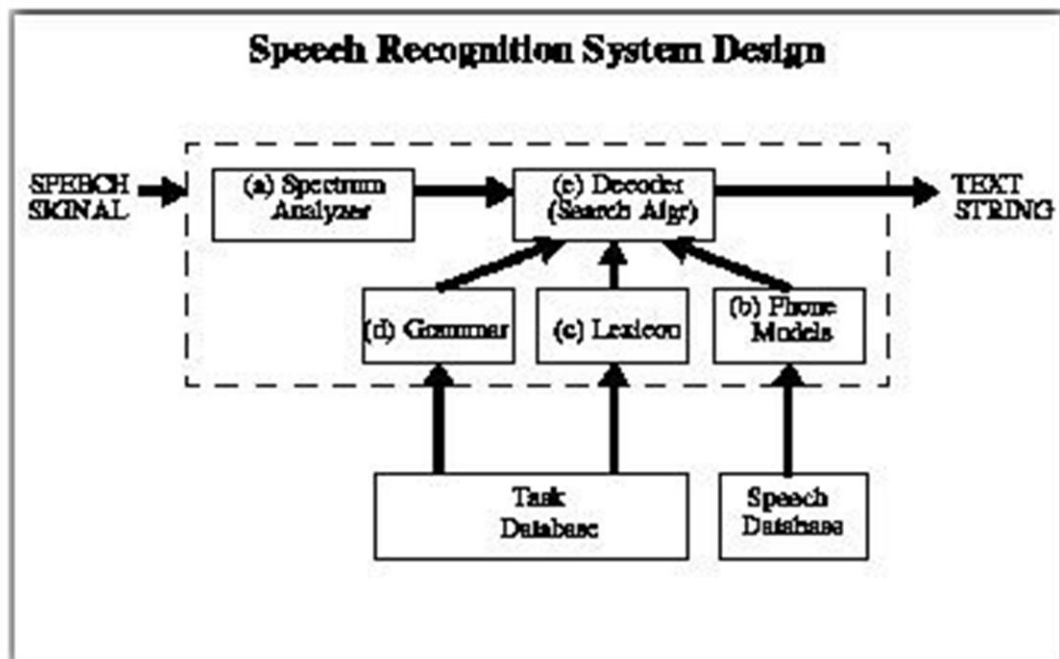


Figure 3: Speech recognition system design of ASD
Source: Autism methodology

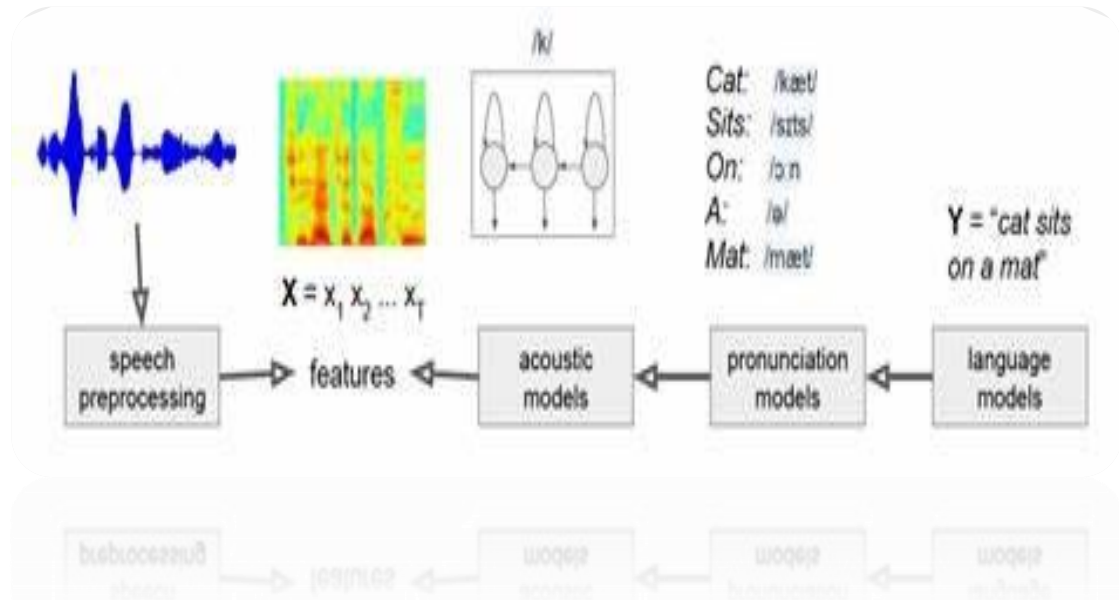


Figure 4: Speech recognition of ASD
Source: error of speech recognition for autism

Research Objectives

Main Objective

The proposed system's ability to support both English and Sinhala languages. Specific Objectives

Specific Objective

To reach the main objective specific objectives that need to be attained are as follows.

- Handle many requests at a time with the proposed tool.

With the proposed platform, intelligent agents will be deployed depending on the current load of requests to be handled and the agents will have the ability to handle multiple conversations simultaneously compared to its human counterpart.

- Increase overall productivity of the service.

Intelligent agents once deployed by the proposed platform will be reactive and efficient. Due to the intelligent agent's ability to interact with multiple users at a time, users of the system can gain in productivity, time, and scalability.

- 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.

METHODOLOGY

Background

The proposed solution will be based on the existing research found in the key areas of the platform such as Speech Recognition, Conversational Artificial Intelligence, and Speech Synthesis with the unique capability of Sinhala Language support and a being standalone decoupled solution. The solution will heavily depend on machine-learning algorithms to achieve human-level intelligence in decision making, dialogue generation and to take activities. The kids' voices will be input into the system. The system's noise reducer removes the noise attached to the current voice file. Then speech recognition engine developed for the proposed solution based on the deep speech implementation [20] proposed by researchers at Baidu, further following the most recent version of implementation being version 3 [10] extracts entities and actions associated with the current voice data into text format. The provided implementation will be tweaked accordingly to support Sinhala speech recognition. The key factor for selecting the above implementation relies on the architecture proposed by the above implementation. Rather than traditional text-to-speech engines with laboriously engineered processing pipelines and poor performance in noisy environments the selected approach is a well-optimized RNN training system that uses multiple GPUs to train on a large amount of varied data. This gives us the ability to train Sinhala language-specific data without having to implement custom pipelines and phoneme dictionary for the language. Further, the implementation highlights its ability to handle challenging noisy environments in the proposed system. The selected solution even supports training via a labelled data set of transcripts. The machine learning model for speech recognition will be trained from the corpus of existing

Sinhala conversations for the Sinhala language. Furthermore, for the English language, Mozilla's common voice data set .

I will focus on my part. It is speech recognition. Speech recognition basically means talking to a computer having it recognized .Shot ASR computer speech recognition or speech to text which normally Google user or many other application use for example Siri Alex makes be Cortana by windows now these are there some

applications some famous applications which used a speech recognition feature and provide a help and support. This process fundamentally functions as a piplinet that converts. speak digital audio from a sound card into recognized speech so it works on a principle of conversion of sound from whatever people speak to digital and then works accordingly basicalluy uses algorithms throught language modeling it involves relationship between linguistic units of speech and audio signals language modeling matches sounds with food sequences to help differentiate between words that sound similar so it has in those sinhala and english modeling and acoustic modeling. Alphabet I and the word this is body part so people devote sound similar when spoken or sand pronounced so the software or the system shold know the difference between AI or when it is used and how it can be framed in a sentence.

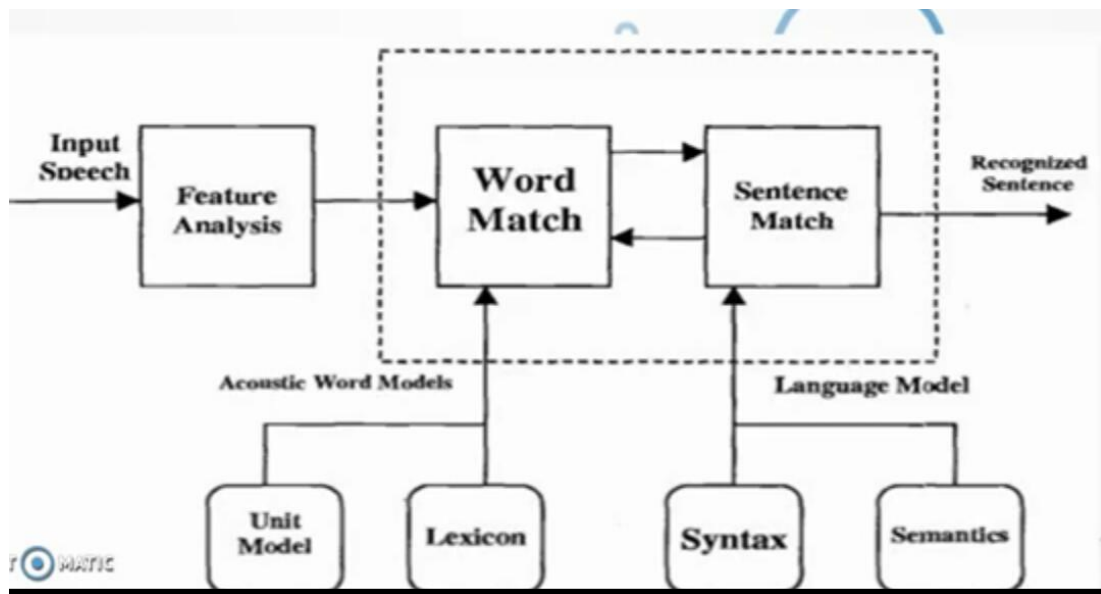


Figure 5: Speech recognition methnology

Source: Speech recognition of ASD

The diagram above shows how it works and when people speak something and it matches the phrases that are invalidated by the character analysis, the antecedent word forms of the previous language model, continue all this, the format and the dictionary and on the other hand the language format phrases And built-in interpretations, all of which are updated from time to time as people begin to use the feature, or when the whole command or sentence that people speak goes into the master mode of the sentence that fits it alone. The final command or the final command or the finished sentence should have gone all that way, or it should have been executed or executed, and then it would have started to be executed, and then the last sentence or the accepted sentence would have been the same sentence sentence as concluded here.

As a summary about methonology ,

- ☐ 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.

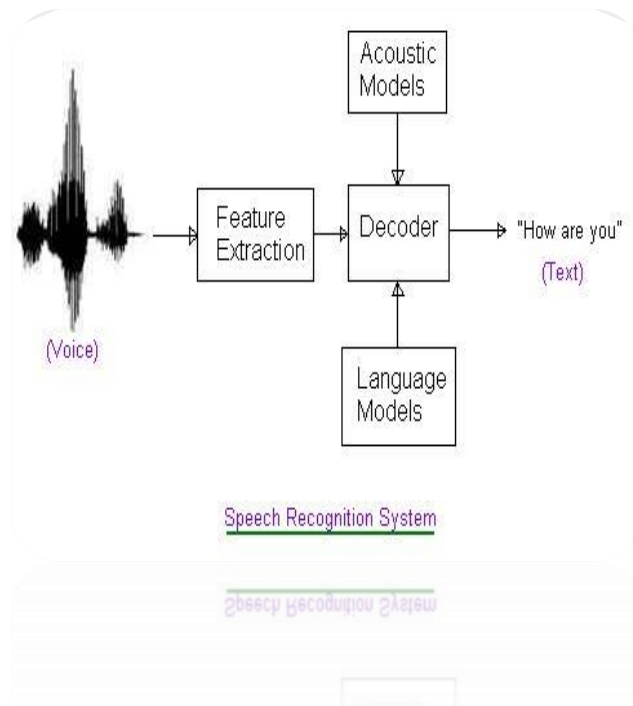
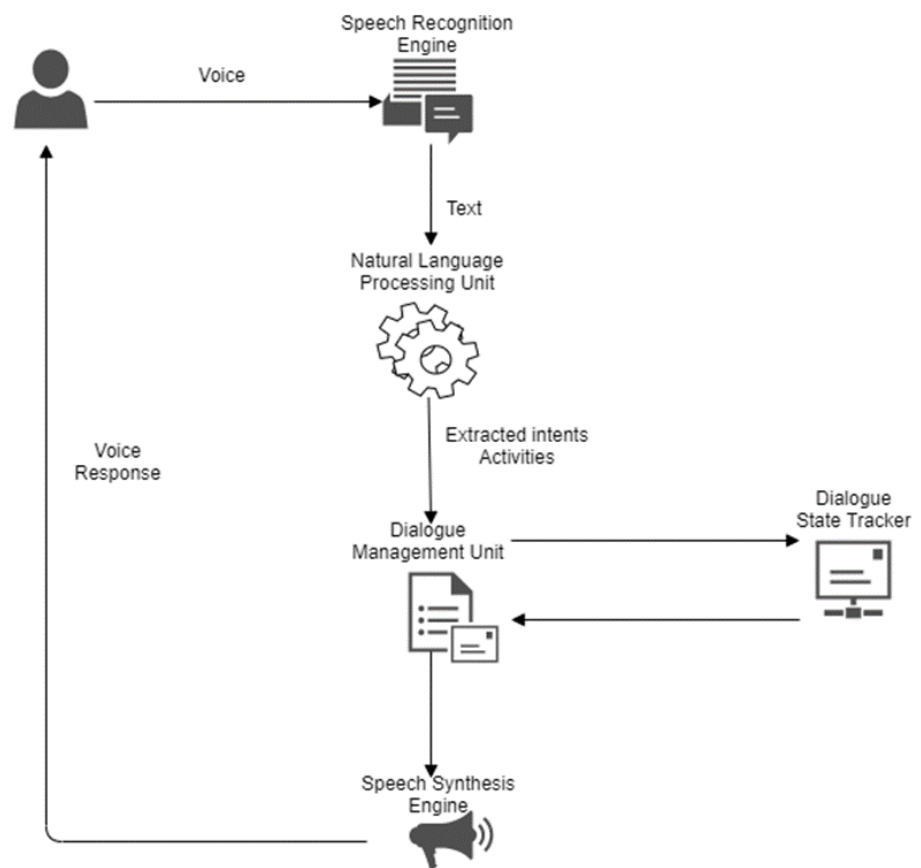


Figure 6: Speech recognition system

Source : Voice convert to text

High Level Architecture Diagram



Project requirements

7.1 Functional requirements

1. Easiness
2. Real time
- 3.Speed
- 4.Accessibility

7.2 Non-functional requirements

- 1.Availability
2. Reliability
- 3.Efficient
- 4.Security
- 5.Accuracy
- 6.Scalability

Hardware Interfaces

- **32-bit or 64-bit(x64) Dual core**
- **2.4 GHz or faster processor**
- **1 GB RAM**
- **Web browser**
- **High quality microphone**
- **Windows 10,8 or 7**

7.4 Software Interfaces

- **Node JS**
- **Python with Anaconda navigator distribution**
- **Windows 10 Operating system**
- **NPM for dependency management system**
- **Tensor-flow library**
- **Visual Studio Code**

System Interfaces

- ☐ **Node JS REST API**
- ☐ **TensorFlow based machine learning prediction API**

Algorithms

- ☐ **Speech to text(STT)**

Testing and System implementation

As the system depends heavily on deep learning algorithms it requires an abundance of label data for speech recognition, natural language processing, and speech synthesis. For the proposed system we need voice conversations with its transcript in-order to train machine learning models. To achieve the above requirement voice conversation data with its generated transcript will be used provided by an existing customer service provider for Sinhala language consist of nearly 1000 hours of data. Regarding English language-based training public datasets like Mozilla common voice will be used. The initial testing process will be carried with the assistance of human agents. At the start system will suggest actions to the human agent based on the ongoing conversation with the kid. The human agent will mark each action as correct or incorrect. Based on the responses by the human agent the system will tweak its responses accordingly and a performance score will be generated for each agent. The evaluation process will be carried out using a performance score generated by the agent as a response to the human agent's correction of actions.

```
1  from __future__ import division
2  import re
3  import sys
4  from google.cloud import speech
5  from google.oauth2 import service_account
6  import pyaudio
7  from six.moves import queue
8
9  RATE = 16000
10 CHUNK = int(RATE / 10) # 100ms
11
12 class MicrophoneStream(object):
13
14     def __init__(self, rate, chunk):
15         self._rate = rate
16         self._chunk = chunk
17
18         self._buff = queue.Queue()
19         self.closed = True
20
21     def __enter__(self):
22         self._audio_interface = pyaudio.PyAudio()
23         self._audio_stream = self._audio_interface.open(
24             format=pyaudio.paInt16,
25             channels=1,
26             rate=self._rate,
27             input=True,
28             frames_per_buffer=self._chunk,
29             stream_callback=self._fill_buffer,
30         )
```

```

35
36 def __exit__(self, type, value, traceback):
37     self._audio_stream.stop_stream()
38     self._audio_stream.close()
39     self.closed = True
40     self._buff.put(None)
41     self._audio_interface.terminate()
42
43 def _fill_buffer(self, in_data, frame_count, time_info, status_flags):
44     self._buff.put(in_data)
45     return None, pyaudio.paContinue
46
47 def generator(self):
48     while not self.closed:
49         chunk = self._buff.get()
50         if chunk is None:
51             return
52         data = [chunk]
53
54         while True:
55             try:
56                 chunk = self._buff.get(block=False)
57                 if chunk is None:
58                     return
59                 data.append(chunk)
60             except queue.Empty:
61                 break
62
63     yield b"".join(data)

```

1.

Commercialization

Task	Cost(Rs)
Backups	1000.00
Text	500.00
Programming	800.00
Other	700.00
Hosting	3000.00
Graphics	500.00
Interface design	700.00
Domain name	7000.00
Marketing	1500.00
Total cost	

RESULTS & DISCUSSION

We use speech as a result of the most communication media to talk about ourselves in our day-to-day life. However, once it involves interacting with computers, except look and enjoying actions, the majority of communication is achieved of late through reading the computer screen. It involves aquatics the online, reading emails, eBooks, analysis papers and many plenty's of and this will be very time overwhelming. still, the visually impaired community in the Democratic Socialist Republic of Sri Lanka is round-faced with long trouble human activity with computers since an appropriate tool is not on the marketplace for convenient use. As an associate acceptable answer to this drawback, this project proposes an Associate in Nursing economical tool for Text-To-Speech conversion accommodating speech in the native language. We use speech as a result of the most communication media to talk about ourselves in our day-to-day life. However, once it involves interacting with computers, except look and enjoying actions, the majority of communication is achieved of late through reading the computer screen. It involves aquatics the online, reading emails, eBooks, analysis papers and many plenties of and this will be very time overwhelming. still, the visually impaired community in the Democratic Socialist Republic of Sri Lanka is round-faced with long trouble human activity with computers since an appropriate tool is not on the marketplace for convenient use. As an associate acceptable answer to this drawback, this project proposes Associate in Nursing economical tool for Text-To-Speech conversion accommodating speech in the native language.

System type	Phone error rate(%)	Word error rate(5%)
Monophone traning	47.48	4.42
Context dependent traning	37.90	4.25
Chaneel adaptive traning	27.74	4.20
Speaker adaptive traning	29.25	6.46
Neural network traning	24.52	3.68

Already here are the pros of speech recognition technology there are many benefits of using the speech recognition system as it seems like it has the ability to make find the autism n children easier people can use it to finish small tasks. This is turn the lights off one turn the car off on other basic routine stuff. Software tasks and computer and mobile devices and over and more software are being used .

CONCLUSION

Today is that autism may look different in child and that people need to increase awareness of this because the general public and unfortunately some professionals might not recognize autism in child and that really affects understanding and acceptance assessments are important for more than just informing diagnosis and first-time diagnosis or someone who has a childhood diagnosis and then finally deciding to pursue or disclose the diagnosis is a really personal decision .Speech is the primary and most convenient way for people to communication Speech recognition streamlines this process much further instantly populating documents as they are spoken our speech recognition works independently and without .

This technology is beneficial for autism child and technology is easily used by the children. These system could also help ESL learners by speaking with the AI they can probably feel more comfortable instead of being anxious and nervous about speaking with other natural speakers so some of negatives are that the experience is seamless people have some problems understanding distinct dialects or accents but with the introduction of the neural net deep learning and neural networks the system can improve and learn and these problems are being resolved.

Machine learning neural networks are helping improve the quality of speech recognition and the improvements digital speech processing allows developers to build applications that provide a smoother user experience and the trend toward

speech interfaces for web applications and IOT system provides a unique opportunity for developers people consider connecting chatbots and AI systems something well.

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