REVA UNIVERSITY

CAPSTONE-BA05

Speech Analysis For Teaching A Vernacular Language

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R19DM006

Topics Covered

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Abstract

- Mobile/Web applications being used to learn a **foreign language or to learn a second language** has attracted many users**.**
- The growth of the global market for the educational app has increased from $3.4 billion (in 2011) to $37.8 billion (2020). *
- Duolingo have expanded over 300 million registered users across the world, launched on 30th November 2011.**
- Indian languages like Hindi,Urdu,Kannada,Tamil and Malayalam are not in focus.
- Urdu learning app which **correct the pronunciation for the words, evaluates the kids performance** and capable of giving **immediate feedback** .
- This application focuses on the main aspects of language learning skills i.e. **Listening, Speaking and Reading.**
- Implementation of Data Mining and **Natural Language Processing (NLP)** techniques like text to speech conversion, Speech Recognition etc.

*https://www.statista.com/statistics/273960/global-mobile-education-market-volume/

**https://en.wikipedia.org/wiki/Duolingo

Problem Statement

Loss or Decline of Vernacular and Indigenous Languages

This is how a Class 4 student reads a Class 2 text in his mother tongue

> *A large proportion of students currently in elementary school estimated to be over 5 crores – have not attained foundational literacy and numeracy*

- Draft National Education Policy 2020

Percentage of students who failed to read even one word correctly

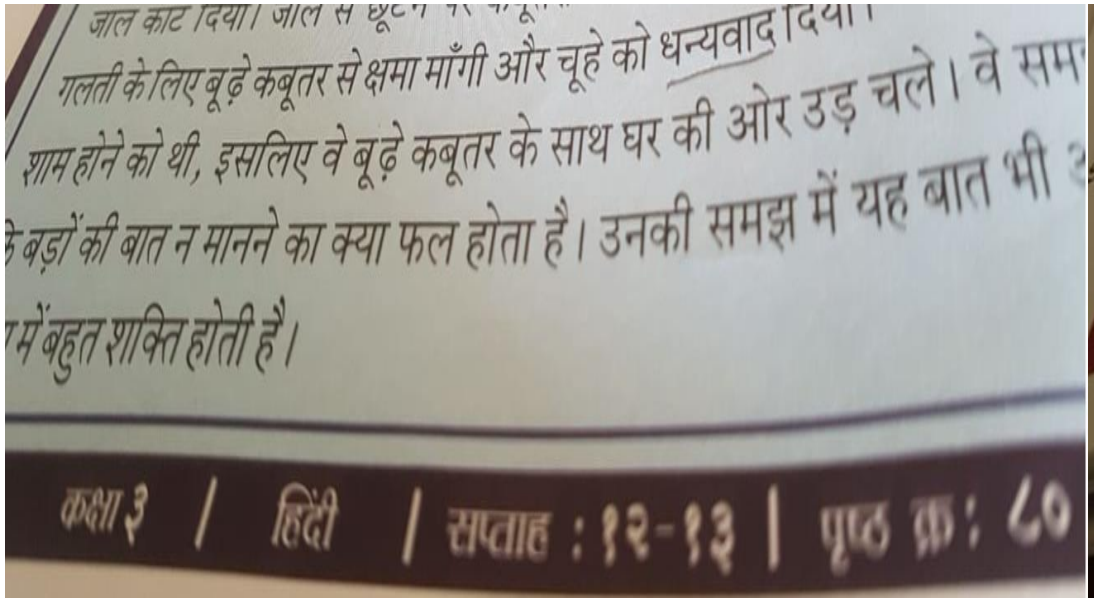
STATE	LANGUAGE	(IN %)
Uttar Pradesh	Hindi	75.9
Rajasthan	Hindi	62.5
Karnataka	Kannada	53.2
Odisha	Oriya	38.8
Uttarakhand	Hindi	30.1
Chhattisgarh	Hindi	23.2
Maharashtra	Marathi	3.8

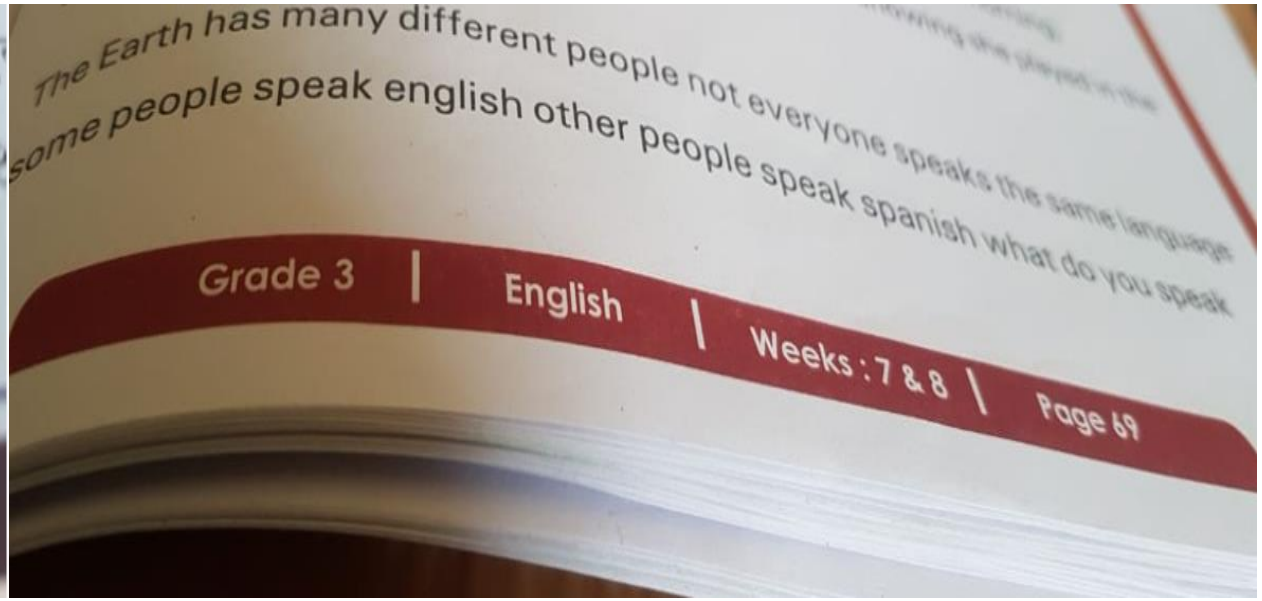
Source: 2018 USAID study conducted in seven states

> *At a potential 100 million children getting through school without basic learning, we cannot afford to underestimate the problem. It has to be a reshaping in the classroom, community and home*

- Ashok Kamath, chairperson, Akshara Foundation

Problem Statement Cont…





Hindi-15 words(2-5 letters)

English-24 words(4-9 letters)

Objectives

Design an application to help a 5 year old to learn Urdu pronunciation by focusing on the important characteristics of the language, providing equal focus to all parts of learning: Listening, speaking & reading .

The application evaluate kids pronunciation for the word in grade1 text book.

Literature Survey

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AUTHORS,PAPER PUBLISHED,YEAR OF PUBLICATION	RESEARCH WORK
Catherine Regina Heil,"*A review of mobile language learning applications: trends, challenges and opportunities* " 2016.	3 major trends: apps tend to teach Vocabulary in *isolated units* rather than in relevant contexts minimally adapt *to suit the skill sets of individual learners,* and lack of explanatory *corrective feedback to learners*.
Asadullah," *Automatic Urdu Speech Recognition Using Hidden Markov Model*" 2016	An approach *for automatic speech recognition of Urdu isolated words*. Findings: *Urdu phonetics and phonology differs widely* from English language *Overall recognition accuracy of 78.2%* for 100 word with the use of deep learning models .
J. Islam, *"A speech recognition system for Bengali language using recurrent Neural network," 2019*	A Speech Recognition System for *Bengali Language using Recurrent Neural Network* , further *improved accuracy by using the CTC loss function and language model. Language* consisting of *diacritic characters are very much difficult to train in a model*

Literature Survey Cont…

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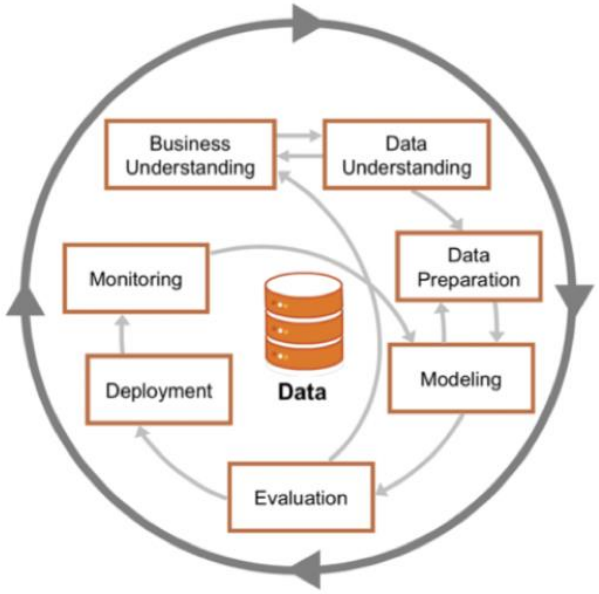
AUTHORS,PAPER PUBLISHED,YEAR OF PUBLICATION	RESEARCH WORK
R. Hincks, "*Speech recognition for language teaching and evaluating: A study of existing commercial products*," *2002*	▪ Tool to practice *spoken language outside the classroom*. ▪ Software helped *students to improve fluency and confidence*. ▪ It provide *individual feedback on pronunciation*, ▪ that is often *lacking in the language classroom*. ▪ Algorithms calculate by how much a given *pronunciation has deviated* from a model, and give a *score on phonetic accuracy*.
https://www.duolingo.com/courses *Read Along (Bolo): Learn to Read with Google* *https://www.quora.com/Are-there-any-good-Urdu-educational-apps-for-kids-to-learn-Urdu*	▪ Popular language-learning *app Duolingo ,no support for Urdu language*. ▪ Google Bolo *Application focuses on a child's reading skills only.* ▪ Learn Urdu Quickly, Learn Urdu Free, and Learn Urdu kids

Approach

CRISP-DM (Cross-Industry Standard Process for Data Mining)



- ✓ **Business Understanding:** App requirement
- ✓ **Data Understanding:** Urdu words from NCERT grade1 book
- ✓ **Data Preparation:** Normalization of the data
- ✓ **Modeling:** Speech Recognition model, Sequence matcher
- ✓ **Evaluation:** Evaluated it with a kid.
- ✓ **Deployment:** Deploying model in Django framework.

Business understanding

- Shortage of teachers causing poor learning.
- One to one interactions is costly affair.
- Teacher Fatigue creates biasness and stress.
- Not a single app available in the market which correct the pronunciation for Urdu language.

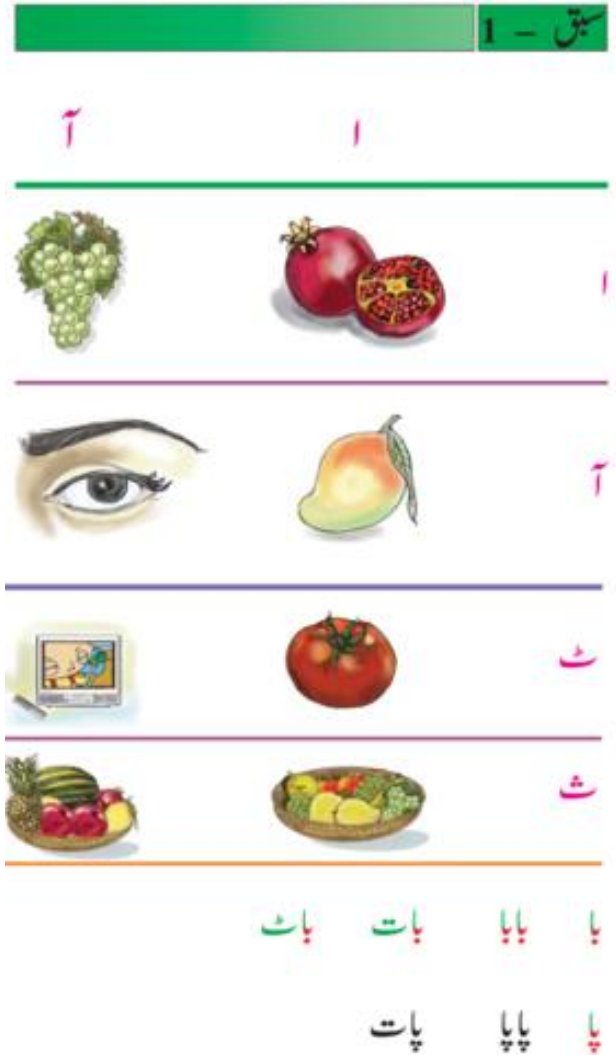
There is *a* ***need to develop an application (A virtual teacher)to assist teachers*** and these kids to ***improve quality of education.***

State of Karnataka Government Schools

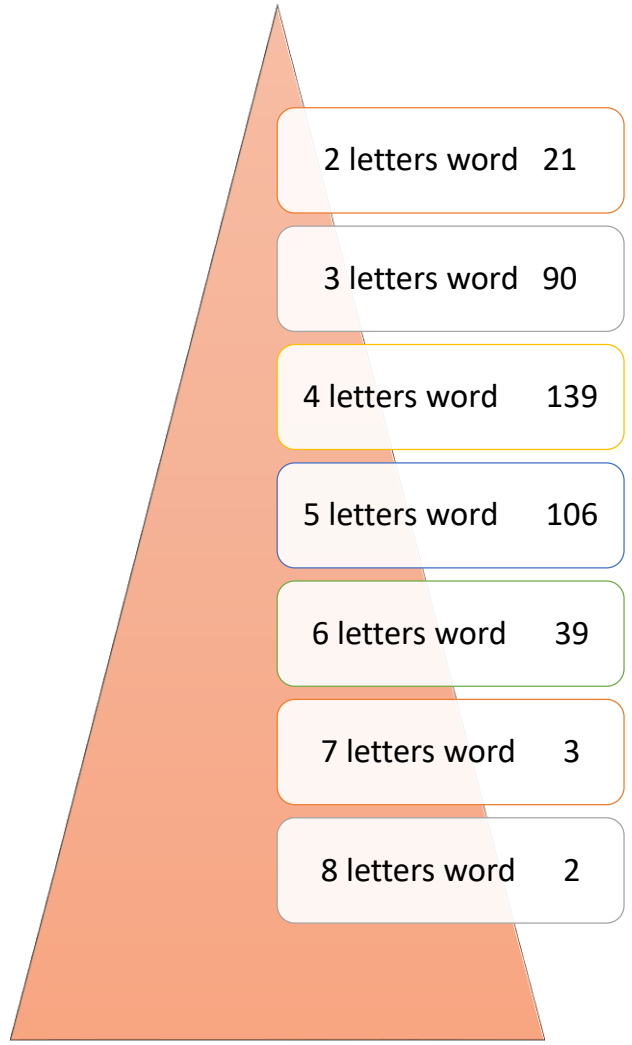
Urdu schools in a pathetic state
bangaloremirror.indiatimes.com

Government Urdu School, Yeshwant...

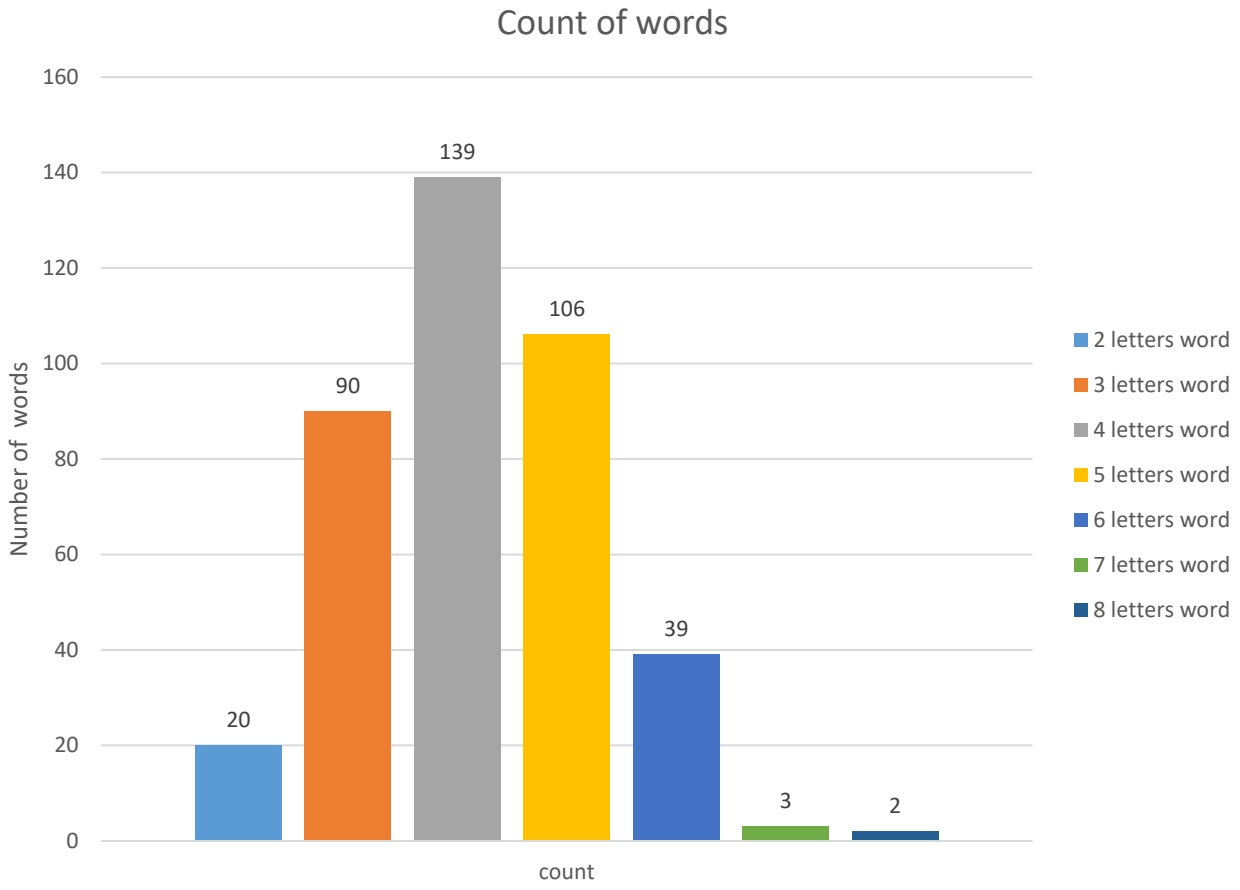
Data Understanding

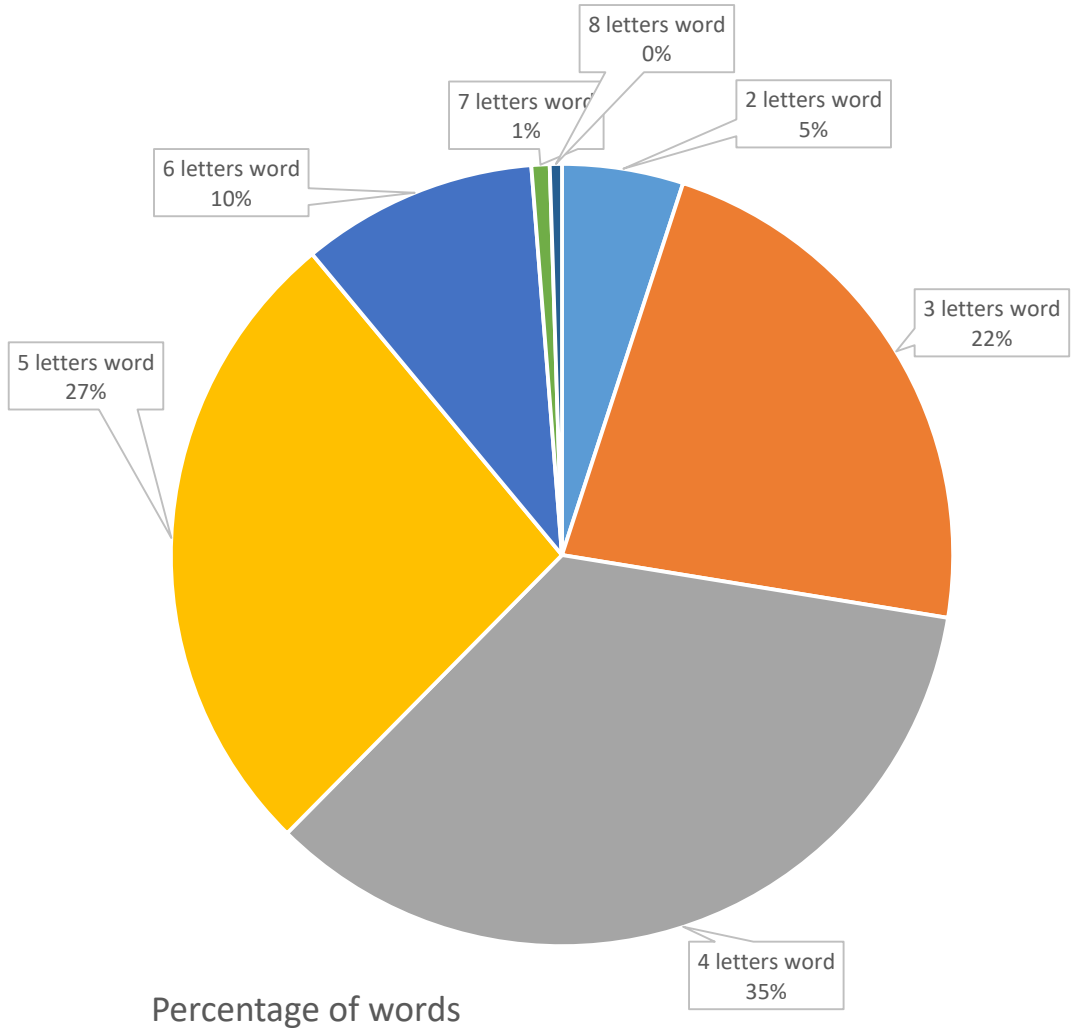


Sno.	Urdu Word
1	انار
2	انگور
3	کیلا
4	سیب
5	آپ
6	اردو
7	بس
8	دس
9	نرس
10	ابر
11	درس
12	پرس
13	تخت
14	بازار
15	سبق

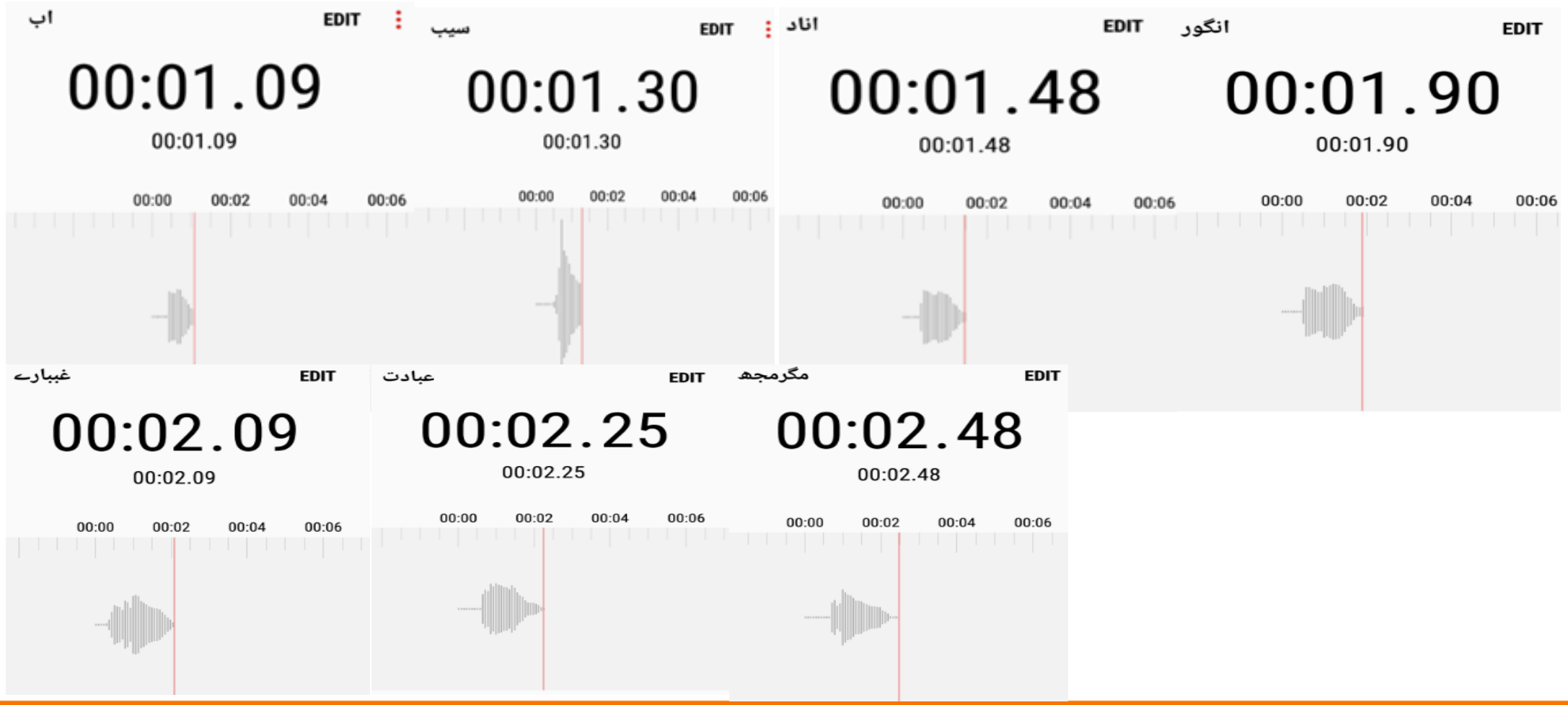


Data Understanding





Data Understanding continue...



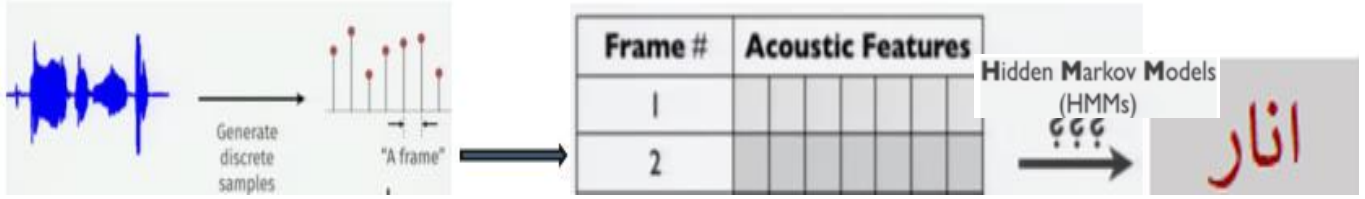
Data Preparation

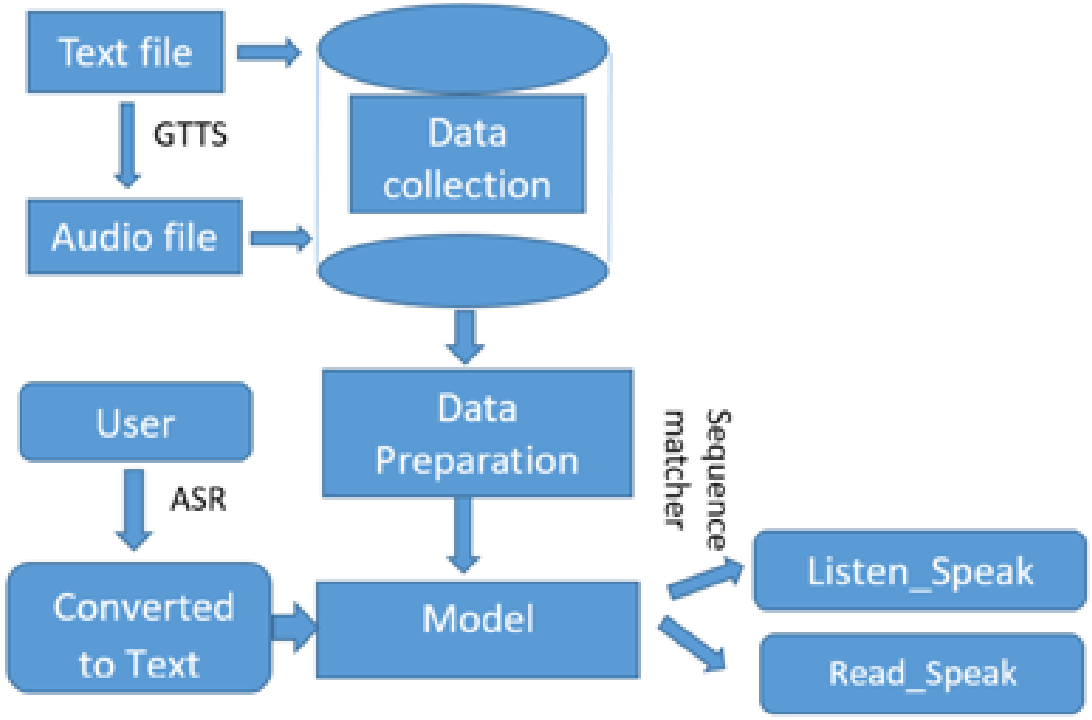
- Dataset has been created with reference to NCERT text book for grade1.
- 7-8 letters words have been removed to avoid confusion.
- Words are arranged according to its difficulty/complexity level.
- Some Conversion of text to audio using GTTS has not worked well ,so creation of those audio files done manually.
- Images has been collected with text book and internet to make the model more interactive.

id	Urdu Word	Audio_files	Image_files
1	انار	audio/1_1.mp3	image/1_1.jpg
2	انگور	audio/1_2.mp3	image/1_2.jpg
3	کیلا	audio/1_3.mp3	image/1_3.jpg
4	سیب	audio/1_4.mp3	image/1_4.jpg
5	آپ	audio/1_5.mp3	image/1_5.jpg
6	اردو	audio/1_6.mp3	image/1_6.jpg
7	بس	audio/1_7.mp3	image/1_7.jpg
8	دس	audio/1_8.mp3	image/1_8.jpg
9	نرس	audio/1_9.mp3	image/1_9.jpg
10	ابر	audio/1_10.mp3	image/1_10.jpg
11	درس	audio/1_11.mp3	image/1_11.jpg
12	پرس	audio/1_12.mp3	image/1_12.jpg
13	تخت	audio/1_13.mp3	image/1_13.jpg
14	بازار	audio/1_14.mp3	image/1_14.jpg
15	سبق	audio/1_15.mp3	image/1_15.jpg
16	جِس	audio/1_16.mp3	image/1_16.jpg
17	جوش	audio/1_17.mp3	image/1_17.jpg
18	شاباش	audio/1_18.mp3	image/1_18.jpg
19	شیشی	audio/1_19.mp3	image/1_19.jpg
20	آسان	audio/1_20.mp3	image/1_20

Model Building

GTTS: Google Text to Speech converter
ASR: Automatic Speech Recognition





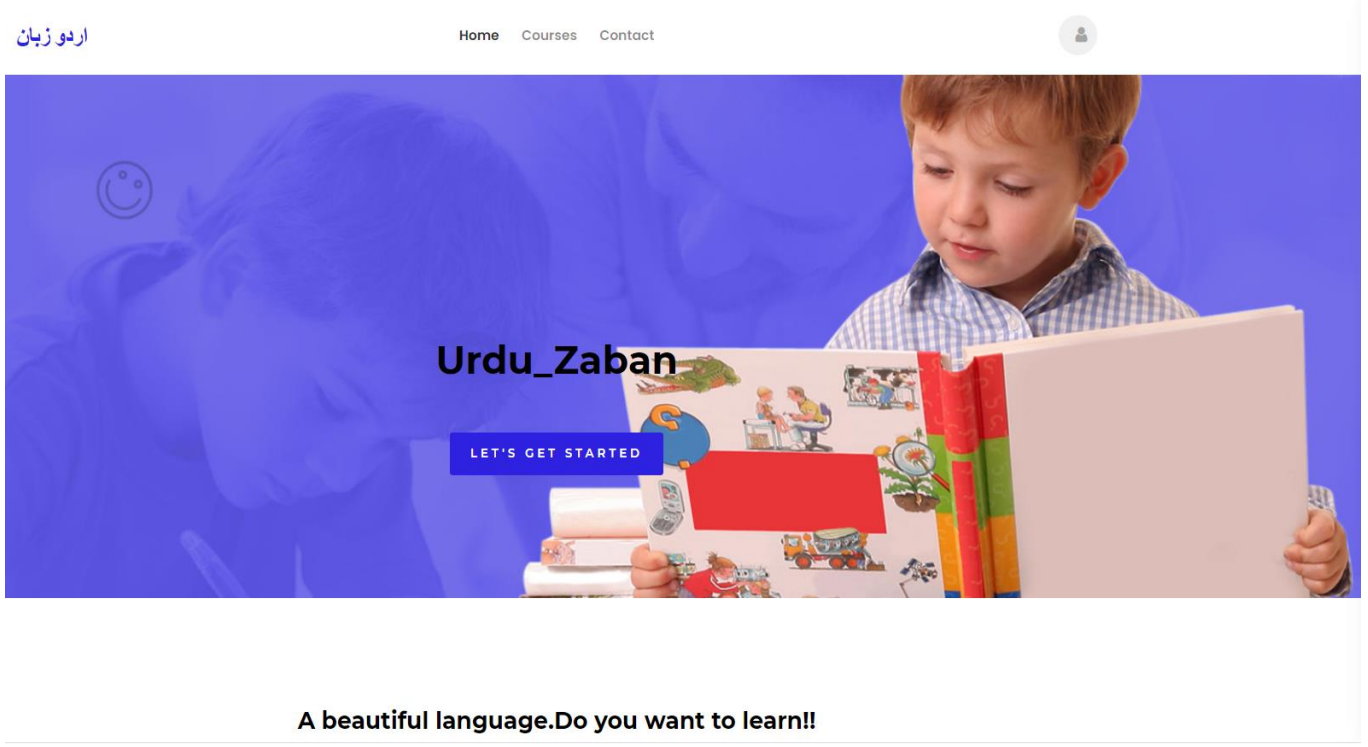
Model Evaluation

- The Error rate of the Listen_Speak model is 8.13% and the Read_Speak model is 8.75% with internal evaluation .

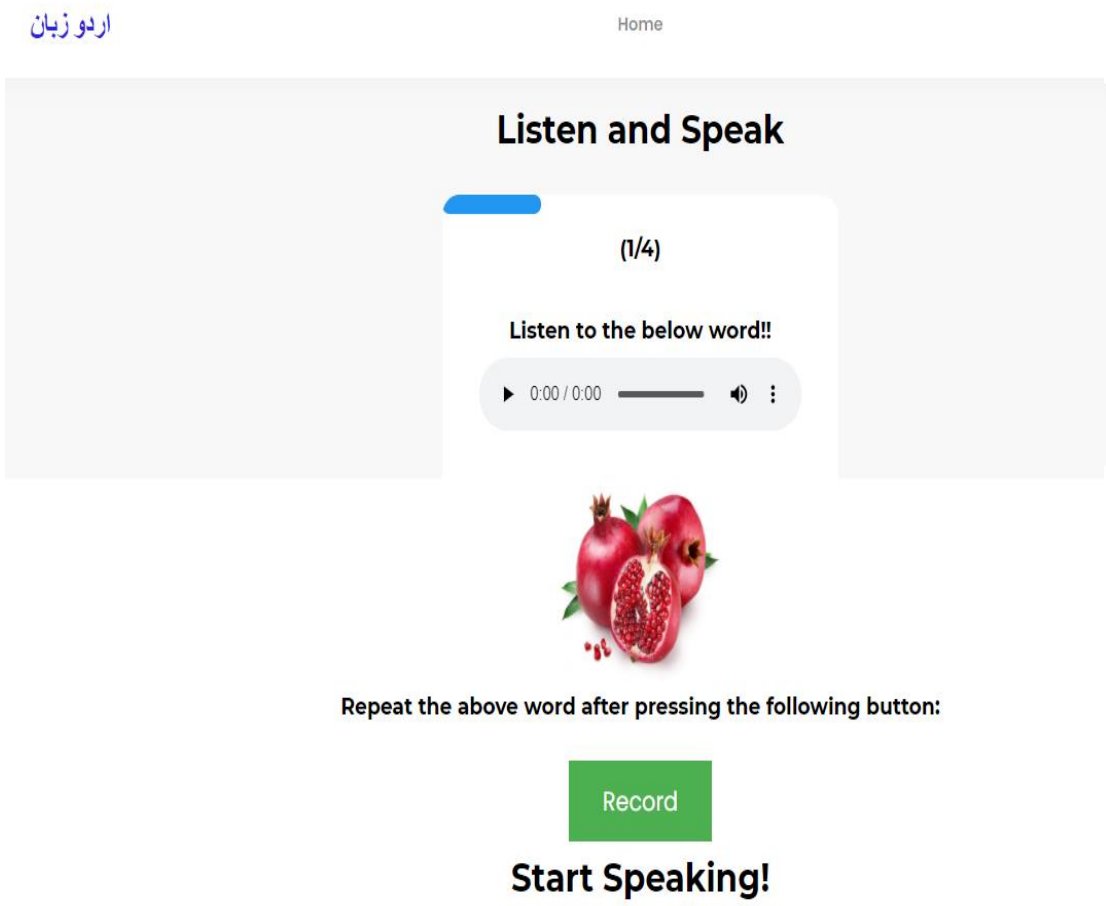
- External evaluation will be done with some government school kids.

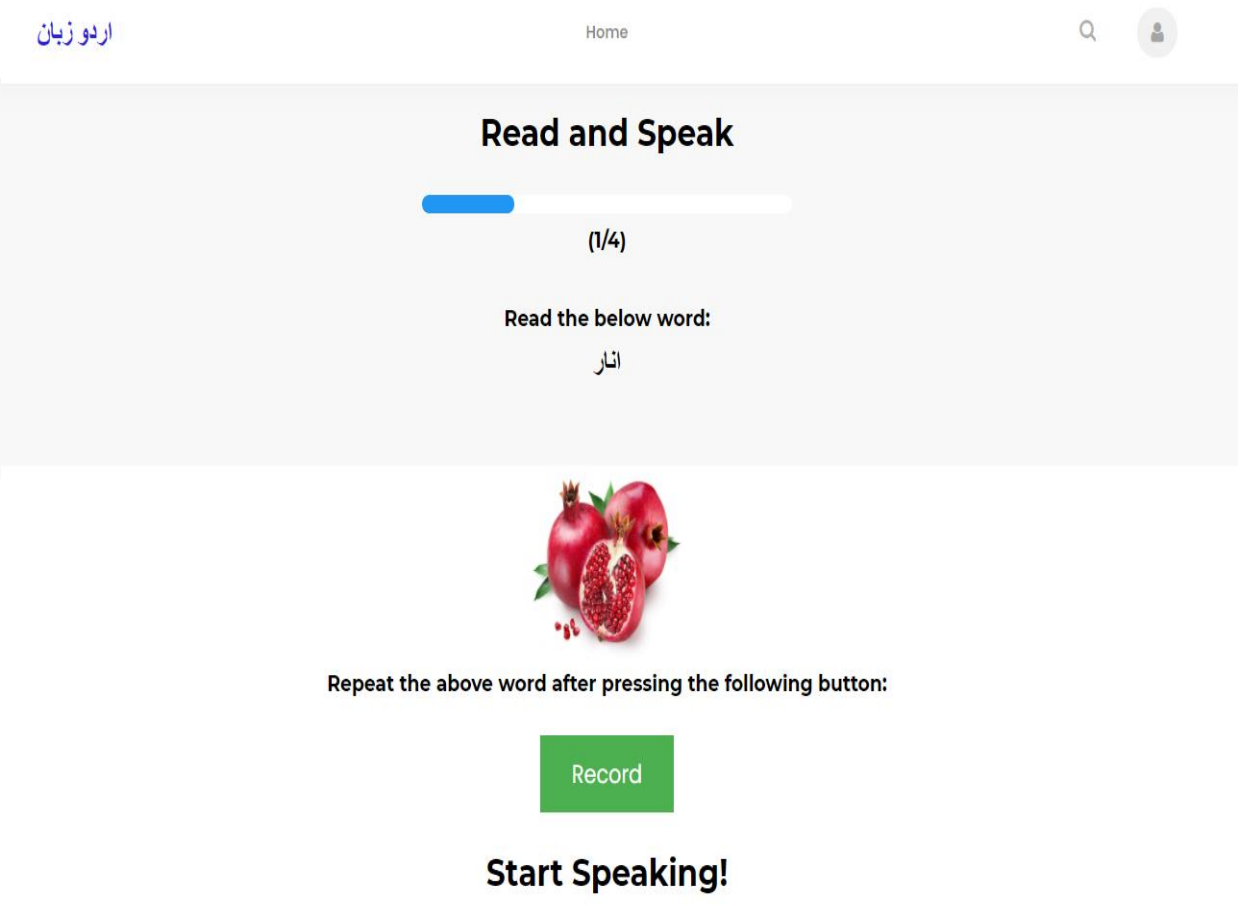
Model Type	Error Rate
Listen and Speak	8.13%
Read and Speak	8.75%

Model Deployment

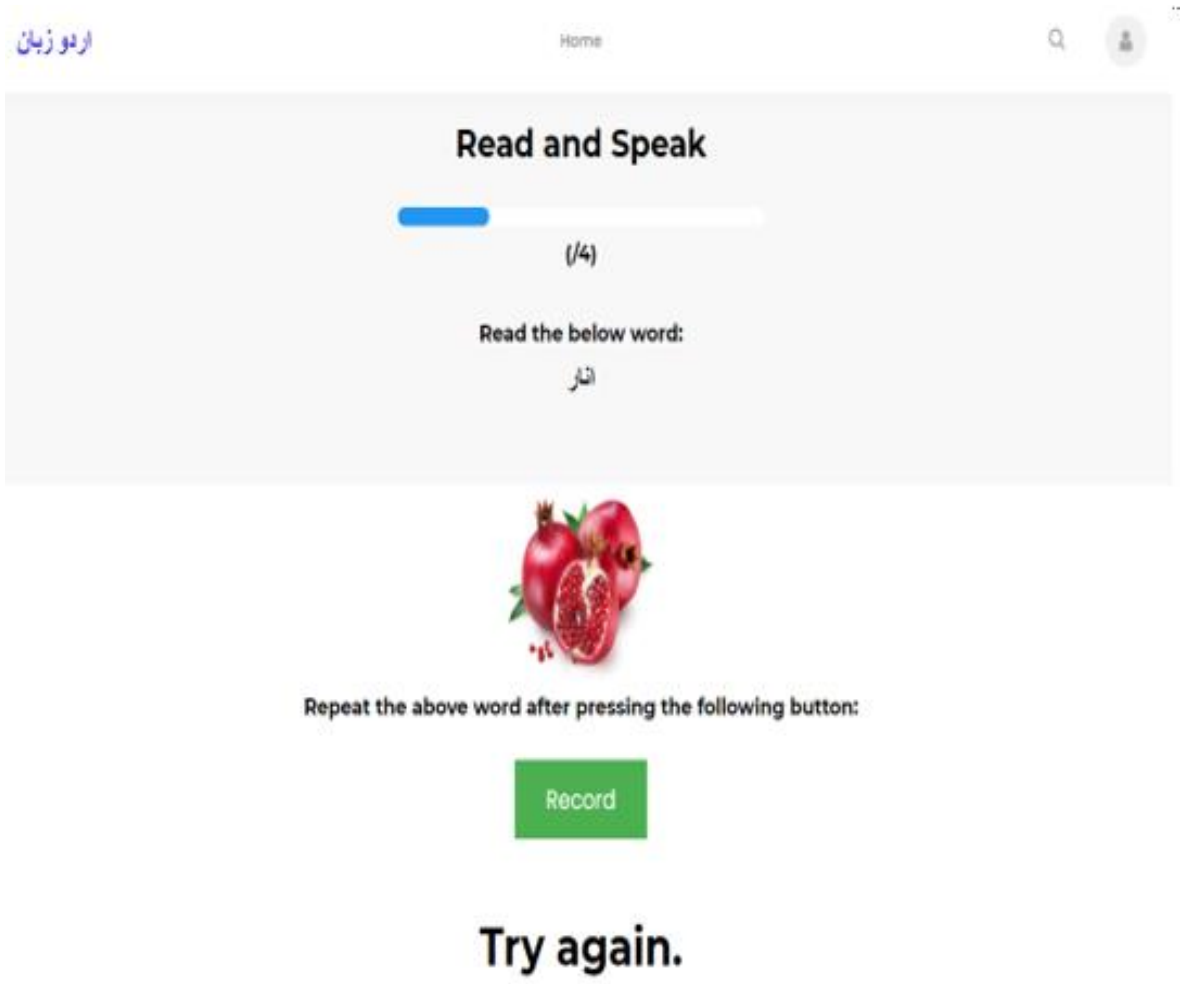


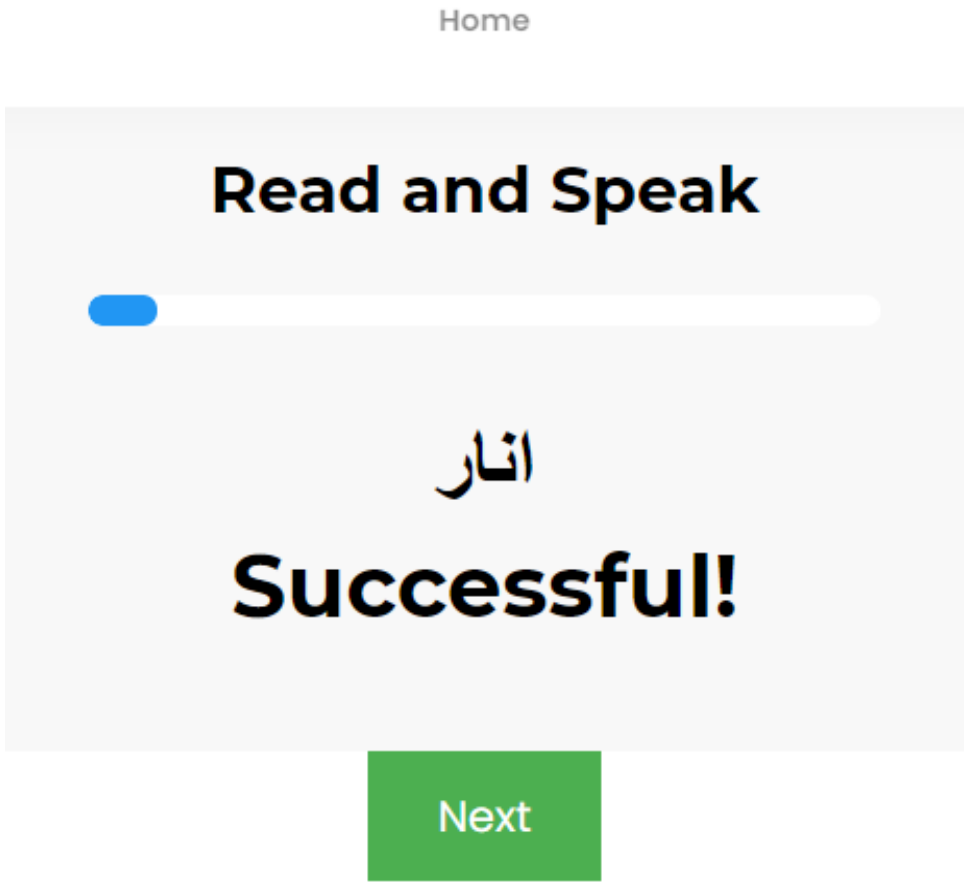
Model Deployment



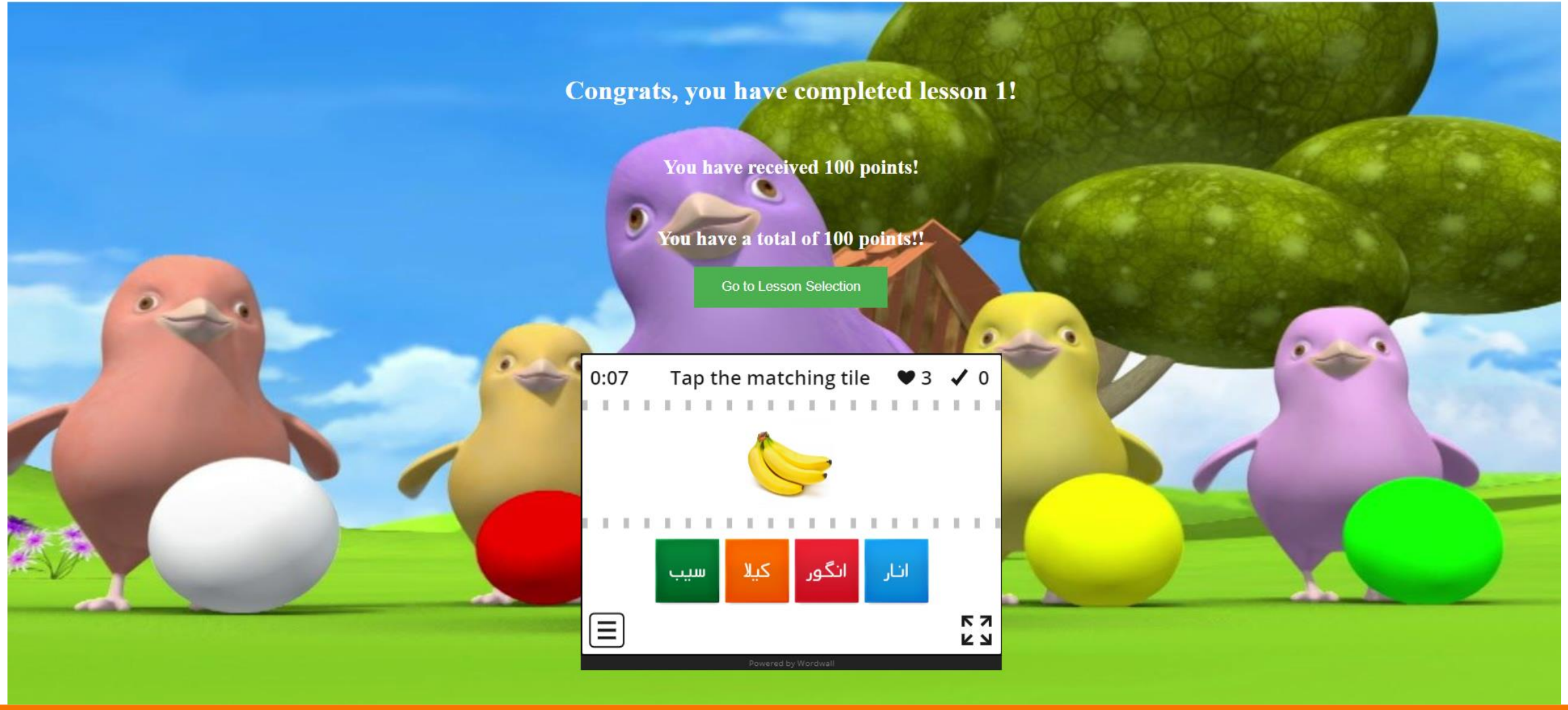


Model Performance





Puzzles in the app



Leaderboard in the Puzzle

Webapp Evaluation

Accuracy of Listen_Speak model 96.25% and Read Speak model are same 95.63% (calculated with a sample of 160 words).

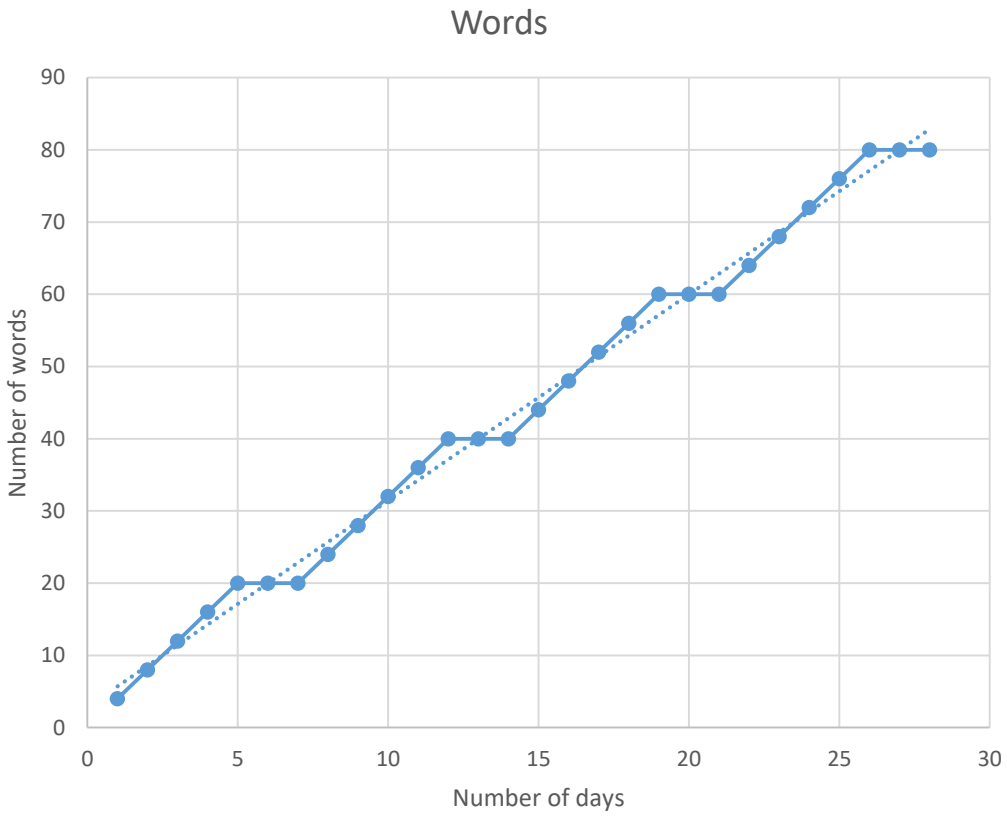
Total=160	**Predicted: Right**	**Predicted: wrong**	
Actual: Right	TP=146	FN=6	152
Actual: wrong	FP=0	TN=8	8
	146	14	

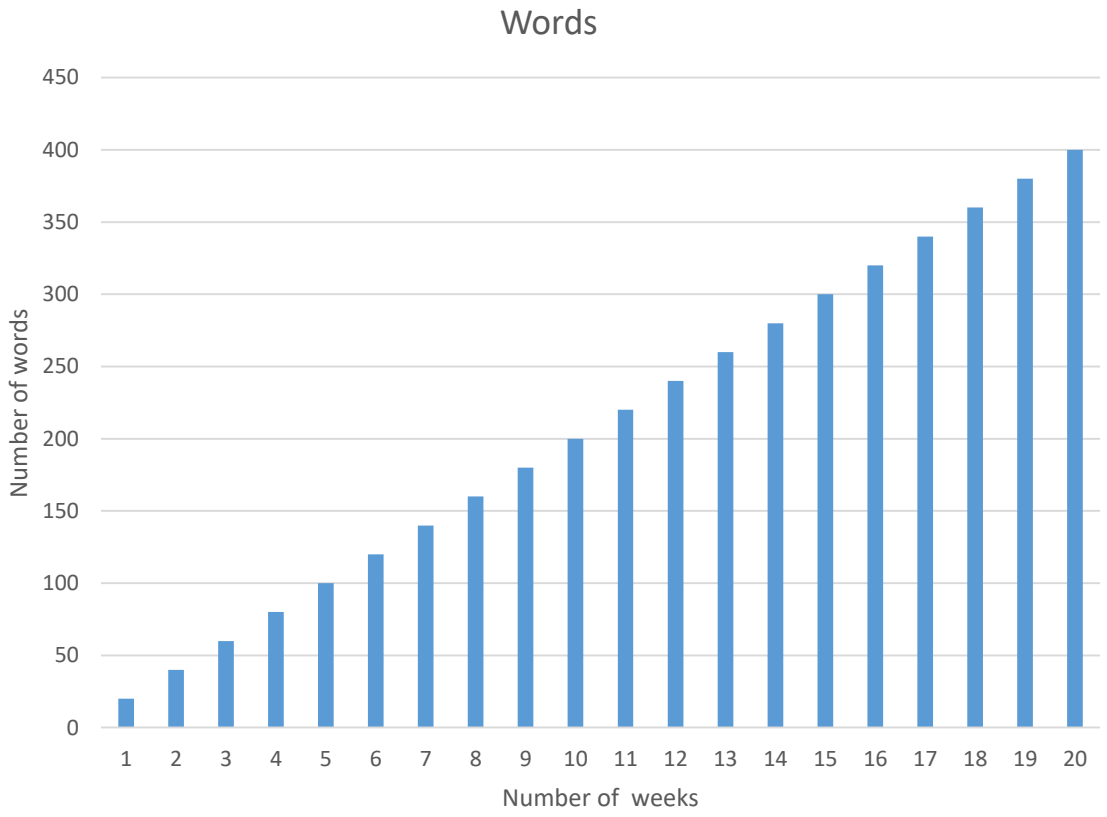
Listen_Speak Model

Total=160	**Predicted: Right**	**Predicted: wrong**	
Actual: Right	TP=143	FN=7	150
Actual: wrong	FP=0	TN=10	10
	143	17	

Read_Speak Model

Assumption with proposed plan





Result and Conclusion

- ✓All 400 words audio file(converted by ML model) tested & evaluated with the teacher.
- ✓Some words are difficult to pronounce ,so kept in the last.
- ✓To make the model more interactive some puzzles and surprizes are included at the end of every lesson(comprising only 4 words)
- ✓Error rate for Listen_Speak model and Read_Speak model are 8.13% and 8.75%.
- ✓Target is to teach 400 words in 20 weeks with gap and revision frequently(spaced repetition technique).
- ✓Reducing the time span of 52 weeks to 20 weeks only.
- ✓With internal evaluation it is found that its easy to use tool to teach and correct the pronunciation of Urdu word from the text book.

Future Work

- Plan to implement Writing evaluation in later stage of the project.
- This work extended for sentence and paragraph level also.
- Furthermore, the similar framework from text book to app can be designed for other subjects like maths, science etc.

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Q&A

THANK YOU