

BANGLA SPELL CHECKER : WEB BASED APPLICATION

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This Report Presented in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Computer Science and Engineering

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DAFFODIL INTERNATIONAL UNIVERSITY

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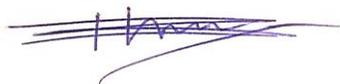
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APPROVAL

This Project/internship titled “**Bangla Spell Checker : Web Based Application**”, submitted by Md. Symoon Reza Patwary Anik, ID No: 172-15-9642 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 3rd June.

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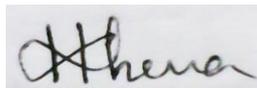
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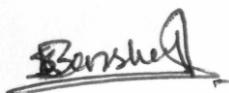


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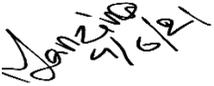
We hereby declare that, this project has been done by us under the supervision of **Mr Saiful Islam, Senior Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:



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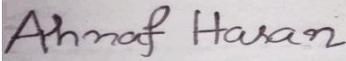
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ABSTRACT

In human generated electronic text, spelling errors and typing errors are abundant. Spell check is a software program that corrects spelling errors in word processing, email and online discussions. Spell check identifies and corrects misspelled words. It also allows you to search a document yourself for words you know you've misspelt. It is desirable that a Speller would search through an active document such as Microsoft word document for invalid or miss-spelled words. Word matching algorithm is required to identify errors in queries where information is available. The searching area might be preselected by highlighting the portion of the document or the checking should run forward starting from the cursor position of the active document up to the end. Functionally, each word is identified on the run and the word is matched with the database of the valid word-stock or word dictionary. If no match is found the word is an invalid or miss spelled one.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In human generated electronic text, spelling errors and typing errors are abundant. Spell check is a software program that corrects spelling errors in word processing, email and online discussions. Spell check identifies and corrects misspelled words. It also allows you to search a document yourself for words you know you've misspelt. It is desirable that a Speller would search through an active document such as Microsoft word document for invalid or miss-spelled words. Word matching algorithm is required to identify errors in queries where information is available. The searching area might be preselected by highlighting the portion of the document or the checking should run forward starting from the cursor position of the active document up to the end. Functionally, each word is identified on the run and the word is matched with the database of the valid word-stock or word dictionary. If no match is found the word is an invalid or miss spelled one.

1.2 OBJECTIVE

A good speller should offer most desired suggestions for the invalid or miss-spelled words, and a great deal of re-search involved for predicting the most desired suggestion. The main objectives of the spell checker are

- a. Desired suggestions for miss-spelled words. The speller would suggest i. Similar sounding (in Bangla) words ii. Find match for suggestion by replacing and/or swapping, and/or deleting and/or inserting one or more characters of the miss-spelled words.
- b. Fast searching or, handling about 0.5 million words efficiently.
- c. The Speller would interact with the active word documents and guide user properly.

1.3 MOTIVATION

In the language technology field, spell checker is one of the most common research applications. The main motive of the spell checker is to identify the incorrect word and correcting them by showing the suggested word. So for error free and correct spelling it is a very useful material for our daily uses. We choose to do this project because there are no bangla free spell checker available in our community. So we often have confusions about the correct spellings of bangla words used both in paragraph and in individual words. We are often doing mistakes in our works while typing bangla and as there is no spell checker in bangla we could not get the suggested words or show the errors. Even while typing in bangla I and my friends often face this incorrect spelling problems. So if we get such an application which will not only identify incorrect words but also give us the suggested correct spelling of the words, then it's going to be very useful and help us in our day to day life.

1.4 EXPECTED OUTCOME

For our Bangla spell checker project our main focus is to provide correct Bangla spelling to the user for error free texting. There are three major outcomes we expect to do is:

1. Identify the word correctly
2. Check the spelling if it's correct or not
3. If the spelling is wrong then showing the suggested word.
4. See the collections of word.
5. Add new words in database.

1.5 REPORT LAYOUT

Chapter 1: Chapter one has shown the presentation on introduction, objectives, motivation, expected outcome. Overall, this section of the chapter describes the entire format of the project report.

Chapter 2: Chapter two provides a discussion on the work that is already been done in the project. The section gives us the other related works similar to our project, scope of problems and the challenges we faced during implementing the project and give the maximum accuracy level.

Chapter 3: In chapter three we have describe about the requirement specification. We have discussed here business process modeling, requirement collections and analysis, use case modeling and description, logical data model and design requirements.

Chapter 4: In this chapter we are describing about the frontend and backend design of the project. Interaction design and use experience and lastly the implementation of requirements. Overall, this section is about design specification.

Chapter 5: This chapter consists of implementation and testing. Implementation of database, front-end design, testing implementation and test results and report.

Chapter 6: The chapter is about impact on society and environment. It is also about sustainability plan and ethical aspects.

Chapter 7: This section is the conclusion part. This is the overview of the total report and the scopes for further developments.

CHAPTER 2

BACKGROUND

2.1 PRELIMINARIES

In this section we will discuss about related work, comparative analysis, scope of the problem and challenges about the project. In the related work section we are going to discuss other project and their methods related to outwork. In challenges section we will discuss about how we increased our accuracy level and the problems we faced is discussed in the scope of problems sections.

2.2 RELATED WORKS

There are some spell checker in the market now. They correct spellings in word processing, email and online discussions. They identify the miss spelled words and correct them. In our spell checker it also identifies the miss spelled words and correct them. But there is no related work like our project. There is no Bangla spell checker in the market. We are implementing a unique approach to build the spell checker. We are using minimum edit distance algorithm. This algorithm is also known as Levensthein algorithm.

2.3 COMPARATIVE ANALYSIS

There is no other free Bangla spell checker to compare with. Our approach is totally different. Our spell checker is dependent on the data set. We are not using any artificial intelligence to correct the word. We are using the minimum edit distance algorithm which is suggesting a word by calculating. If the word the user gave input is not present in our dataset it will pass it will consider the as wrong.

Because it does not have any intelligence to judge the word. So we can say that our spell checker is totally dependent on dataset. If we increase our dataset then it will be more efficient and accurate.

2.4 SCOPE OF THE PROBLEM

We have faced some problem during implementation process and data collection. We have gathered a large amount of dataset. We worked on data processing very well. We faced some difficulties in data processing and after our hard work we could overcome it. We got stuck when we were working on our framework and it took some time for us to make it possible. Implementation of data was also a problem and make them optimal.

2.5 CHALLENGES

In our project Bangla spell checker we did some good works. But it was not possible for us to make this happen if we had not overcome the basic challenges. The challenge that we were in-front-of are given in followings:

1. Data collection
2. Implementing the algorithm'
3. Data processing
4. Keeping the data optimal
5. Doing clean implementation

This are the challenges we faced to make our maximum accuracy level and give the accurate output we were expecting.

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 REQUIREMENT ANALYSIS

Here we are doing our requirement analysis in two steps. Those steps will give a clear idea about our needs for the project. The specification of those steps are given below:

Step 1: Development Requirement

In this step we are developing our requirements. Firstly, in a spell checker we need to know the word I gave as input is correct or not correct. Then if the word is not correct it should provide a suggestion. To do that we will need an algorithm. After our research we found that Minimum edit distance also known as Levensthein distance algorithm is the best choice for us. Because it gives us 100% accuracy. Then for giving a suggestion or checking the word is correct or not we need a data set. Then we want to run the Bangla spell checker in a web page. In web page we need an input text field and a button called check.

Step 2 : Write and Document Requirements

In this we will be writing the specific requirements.

1. Python : we need python to construct the algorithm. Also, there is no other programming language to read Bangla easily. So, I think python is the best option.
2. IDE: To compile python we need a python IDE. In my case I am comfortable with PyCharm. So, I am choosing PyCharm IDE to compile python.
3. Data Collection: To execute this Spell Checker we will needing a huge amount of Bengali word. Efficiency of the spell checker is depending on the number of data we collected.
4. Dataset: We need a dataset to execute the algorithm and check if the word which we gave input is correct or not.

5. Minimum Edit Distance Algorithm: This algorithm is giving us the output. We can say that Minimum Edit Distance Algorithm is the backbone of Spell Checker.
6. Django: Basically, Django is a python web framework. We want to run our spell checker in a web page so that we need Django.
7. Front-End Design: We will be Using HTML, CSS, BOOTSTRAP to design our Front-End.

After that we will check again to ensure that we don't miss anything. After discussing the requirement those will be enough to build the project. Now we know how needs of our project. It will help us to build the project.

3.2 USE CASE MODEL AND DESCRIPTION

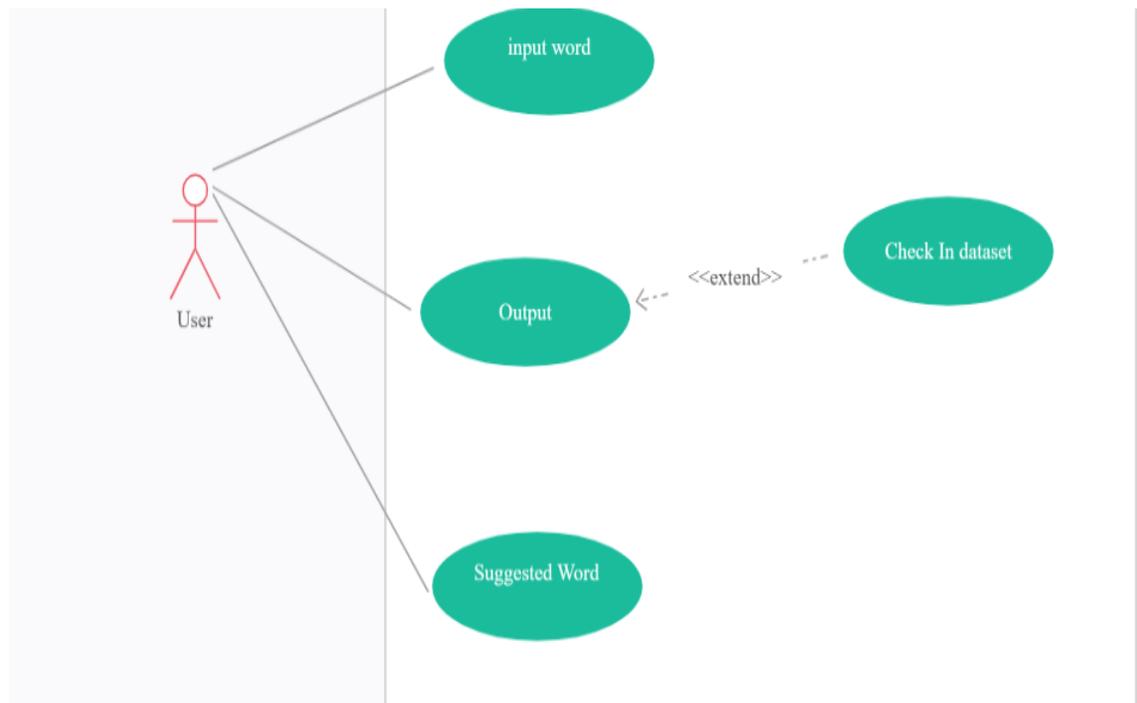


Fig 3 .2.1 Use Case Model

Use Case Name	Actors	Pre-Conditions	Post-Condition	Related Use Cases	Stake Holders
Spell Check	User	Input a Bangla Word	Follow The Given Output	Check In Dataset	Users, Creators

Table: 1.1 Use Case Description

3.3 DESIGN REQUIRMENTS

In web page there will be an input text field where the user can input his query. Bottom of the input text field we want to create a Check button. By clicking the button, they can see the given input is correct or not in basis of dataset. If the given input is incorrect the bottom right side there will be showing suggestions for words. So, if I point out the requirements its stands like

1. Input Text Field
2. Check Button
3. Showing Suggestion at Bottom Right Side
4. Add new words
5. Collection of words and search a particular word

3.4 BUSINESS PROCESS MODEL

BPM or Business Process Model is the graphical depiction of an association's business methodology or work forms, as a technique for perceiving potential updates. It fuses somemethod, starts and picture, condition as like a stream layout. In our system we fabricate a BPM model which advises the most ideal approach to director move the thing nuances.

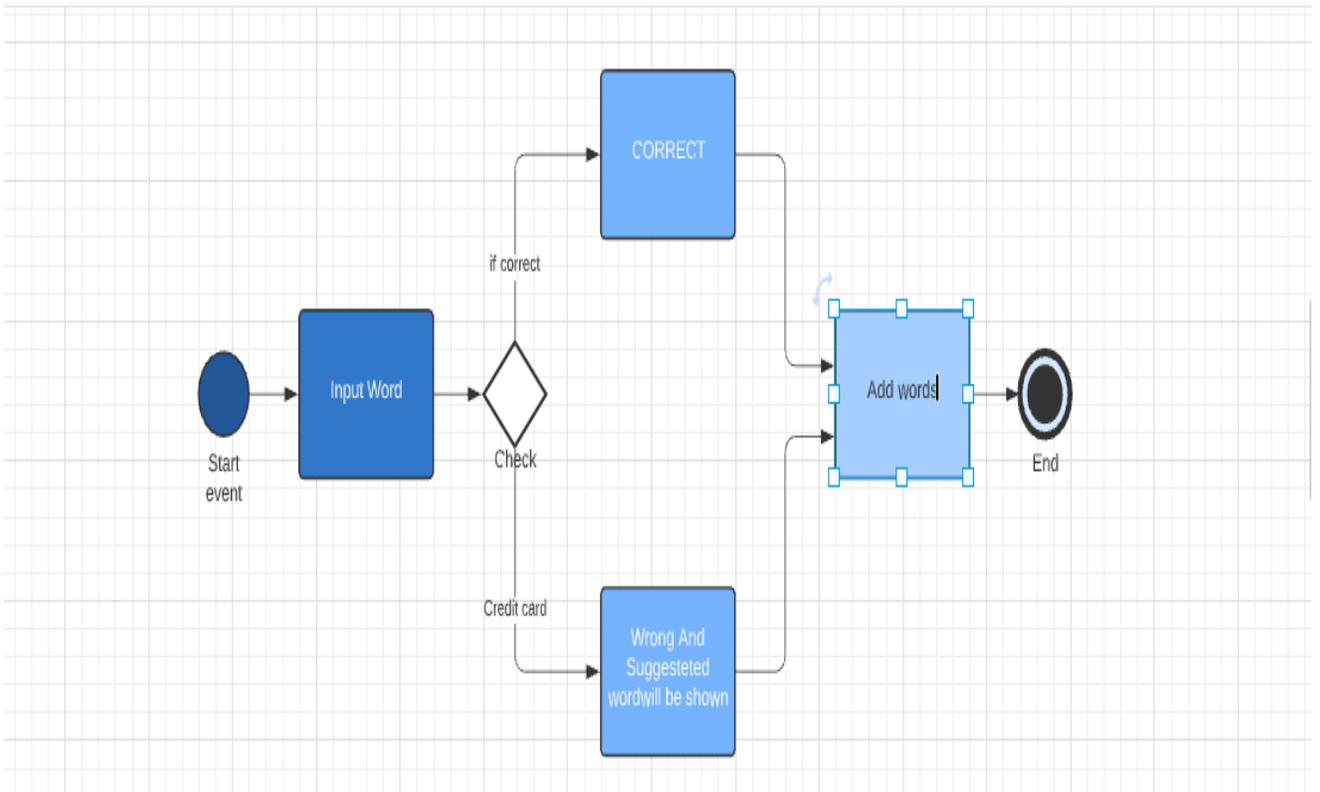


Fig : 11.1 Business Process Model

CHAPTER 4

DESIGN SPECIFICATION

4.1 FRONT-END DESIGN

Front-end designing is so important because this is way of interacting with clients. There are many front-end designing languages. We have use three of them. Which is suitable for our project. Name of the three languages are given below:

1. HTML
2. CSS
3. BOOTSTRAP

By HTML we have made our basic structure. Specifically, we can say that by using HTML we have created a input text field for giving the input word or sentence. We have added a button which is labeled as check. And we are using CSS and bootstrap to describing the presentation of web page. It includes the background color, layout, fonts. The main reason for using Bootstrap is that it maintains wide browser compatibility. Bootstrap provides responsive design. It's also provides consistent design by re- usable components.

Query Sentence

Check

No query is made yet!

Fig : 4.1 Front-end Design

This figure shows our Home Page of Bangla spell Checker Site Design. In this Page we have a Input text field where we would input our desired word. This page also consist a check Button by clicking this button we can check that our given input word is correct or not.

Add new words(space separated)

No new words are saved yet!

Fig: 4.1.1 Front-End Design

This Figure shows our add word page. This page is consist an input text field and a Add Button. In this page we can add any word to our dataset. Then a message will be generated Right below of the input text field.

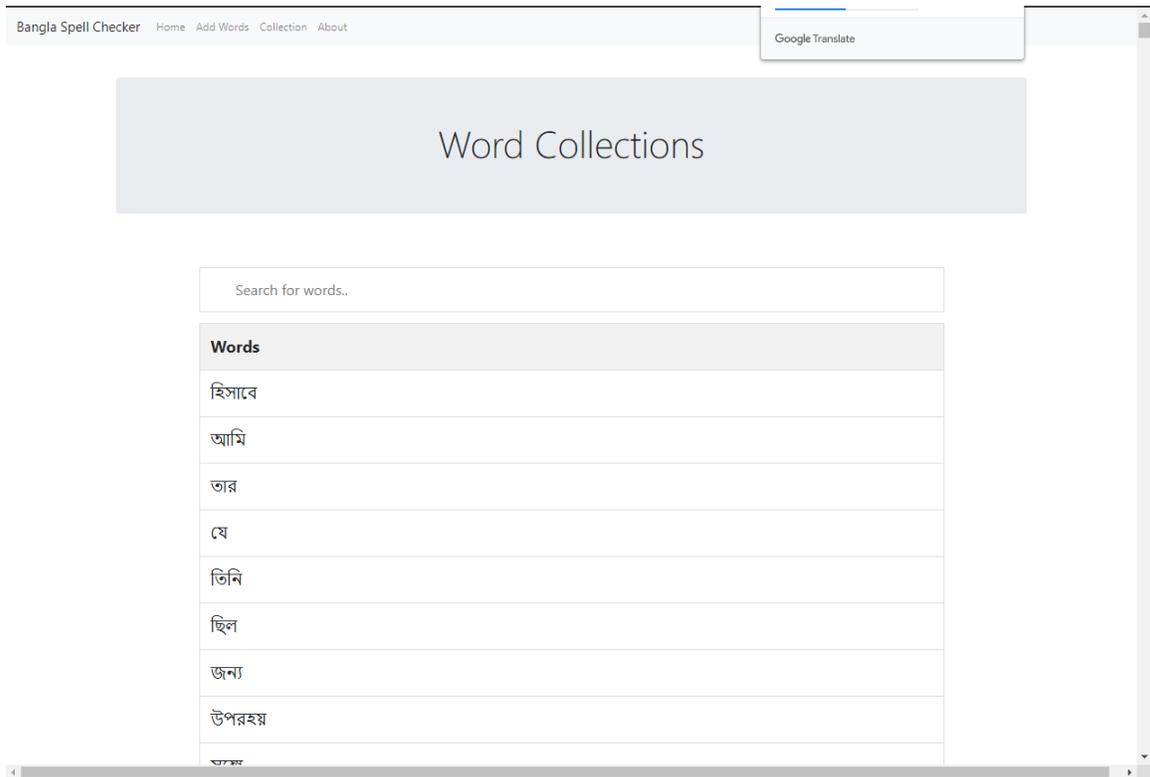


Fig: 4.1.2 Front-End Design

This figure shows Word Collection page. This page consist the dataset of our project. Also there is search option to check if the word is exist or not.

About Us



Fig: 4.1.3 Front-End Design

This figure shows our about page. In this page we have given our information.

4.2 BACK-END DESIGN

The back-end design of our program is designed by using Python and Django. We have constructed our algorithm to the back-end with python. We have made the django setup in this project back-end. This is the framework of python which made our project to run in the website. We have many things to tell about our back-end design. Suppose if we hit the URL, it is going to the 'urls.py' and matching the URL from back-end. Then in this program it is making content request from 'views.py'. then it is going to the templates> index.html file and in the index.html file through Django templates the data is being completed and showing the data from there. There are many more algorithms that we used in this back-end part.

4.3 INTERACTION DESIGN AND USER EXPERIENCE (UX)

In the UX design we can see while we run our project there is ;

- i. An Input text field
- ii. A Button
- iii. A Suggestion message
- iv. Add Words
- v. Collection
- vi. About

In the input text field, we can give our input word, sentence or paragraph. After giving the input there is the button below. When we click the button then a message is shown right side of the page whether the word is right or wrong, if wrong suggest the correct words. There is also a button called add words in navigation. Also there is button called collection where you can see the word we have collected. There is a button called about by this you can get a idea about the creators. In the collection option you will get a search option where you can search for a particular word if it is included in our dataset.

We added a screenshot below where you can get idea about our UX design.

Query Sentence

Fig: 4.3.1 UX Design

4.4 IMPLEMENTATION REQUIREMENTS

The spell checker is executing the Levensthein distance algorithm and finding the suggested from the list. We are still in the initial phase in of this project so that we have not implemented any database in this project. We storing the data in a text file. After taking input the program will split the by space that means converting the sentence into words. After that the program will check if the words are stored into the text file or not. If the word is not stored in the text document, then it will find minimum edit distance between input word and all word from text document. Then program will find the minimum value of minimum edit distance and search all words for that value. To test the software, we choose to apply the black box testing of manual testing methods. To do manual testing we need to build some test cases. To build the test cases we need to create some test data firstly. The test data should create before test execution. In this testing firstly we have to check that if there is no data given then how the system reacts. Secondly, we have to check if there we input valid data then the system is giving the expected result or not. Then we have to check if there we give an invalid data input how the system reacts.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 IMPLEMENTATION OF DATABASE

The spell checker is executing the Levensthein distance algorithm and finding the suggested from the list. We are still in the initial phase in of this project so that we have not implemented any database in this project. We storing the data in a text file. After taking input the program will split the by space that means converting the sentence into words. After that the program will check if the words are stored into the text file or not. If the word is not stored in the text document, then it will find minimum edit distance between input word and all word from text document. Then program will find the minimum value of minimum edit distance and search all words for that value.

Here are some sample of our text document are given below :

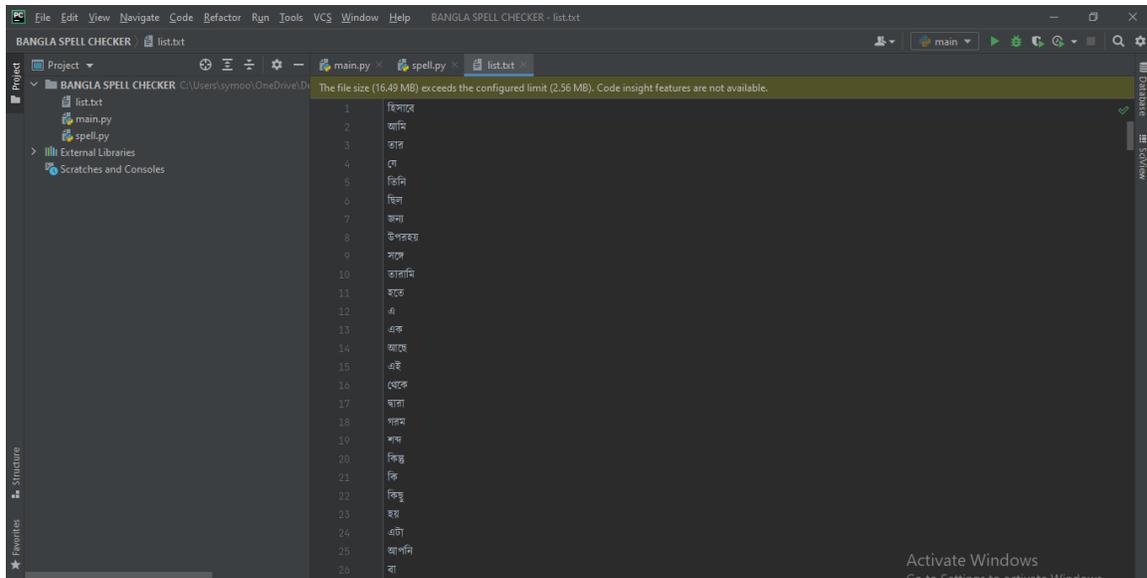


Fig 5.1.1 Data Set List

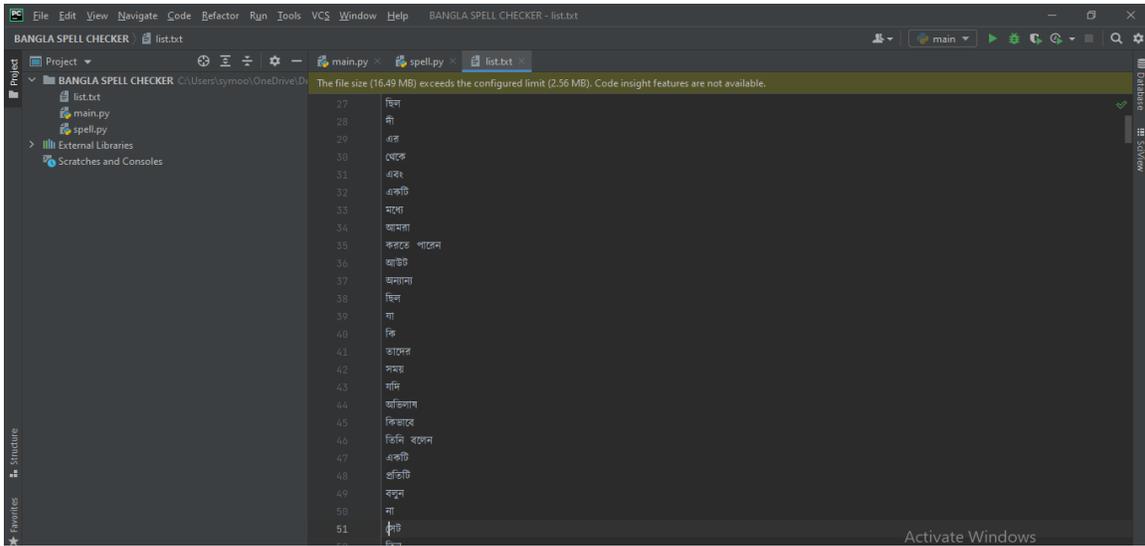


Fig 5.1.2 Data Set List

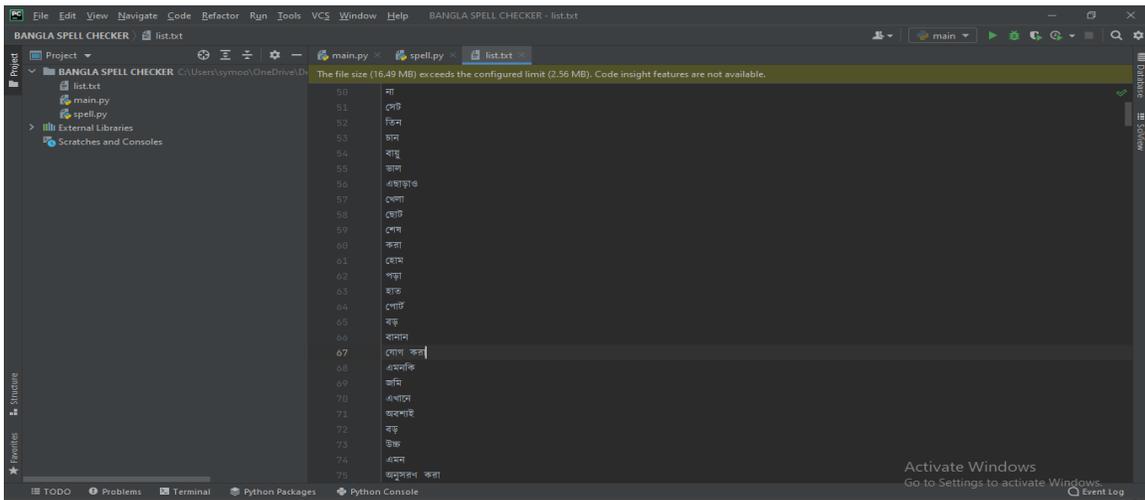


Fig 5.1.3 Data Set List

5.2 IMPLEMENTATION OF FRONT-END DESIGN

Front-end designing is so important because this is way of interacting with clients. There are many front-end designing languages. We have use three of them. Which is suitable for our project. Name of the three languages are given below:

1. HTML
2. CSS
3. BOOTSTRAP

By HTML we have made our basic structure and we also have created a input text field and a button which is labeled as check. And we are using CSS and bootstrap to describing the presentation of web page. It includes the background color, layout, fonts. The main reason for using Bootstrap is that it maintains wide browser compatibility. Bootstrap provides responsive design. It also provides consistent design by re- usable components.

5.3 TESTING IMPLEMENTATION

To test the software, we choose to apply the black box testing of manual testing methods. To do manual testing we need to build some test cases. To build the test cases we need to create some test data firstly. The test data should create before test execution. In this testing firstly we have to check that if there is no data given then how the system reacts.

Secondly, we have to check if there we input valid data then the system is giving the expected result or not. Then we have to check if there we give an invalid data input how the system reacts.

The valid test data for testing are

1. আমরা
2. মানুষ
3. হাত

Those are the valid test data for the testing.

The invalid test data are :

1. Amra
2. Manush
3. Hat

Now we will be creating some test cases to check the Spell Checker. The test cases are :

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result
1	Check User input word is correct or not	<ol style="list-style-type: none">1. Go to site https://bangla-spell-checker-diu.herokuapp.com/2. Enter the word which you want to check if its correct or not3. Click Check Button	আমরা	Correct message will be shown.
2	Check User input word is correct or not	<ol style="list-style-type: none">1. Go to site https://bangla-spell-checker-diu.herokuapp.com/2. Enter the word which you want to check if its correct or not3. Click Check Button	মানুষ	Wrong Suggested Word Will be shown
3	Check User input word	<ol style="list-style-type: none">1. Go to site https://bangla-spell-checker-diu.herokuapp.com/2. Enter the word which you want to check if its correct or not	হাত	Correct

	is correct or not	3. Click Check Button		
4	Check User input word is correct or not	<ol style="list-style-type: none"> 1. Go to site https://bangla-spell-checker-diu.herokuapp.com/ 2. Enter the word which you want to check if its correct or not 3. Click Check Button 	Amra	Wrong and suggested word will be shown

Table: 1.2 Test case

Now we will be testing The Add word Page. To test this page firstly we need to develop some test cases. In the given below table we will be develop our test cases to test that page.

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result
111	Add a word to the dataset	<ol style="list-style-type: none"> 1. Go to site https://bangla-spell-checker-diu.herokuapp.com/add_word/ 2. Enter the word which you want to Add 3. Click the add button 	সাইমুন	সাইমুন Added Successfully

Table : 1.3 Test case

Now we will test the word collection page . The word collection page a search option. We will be testing the search function. To test this function we need to develop Some test cases.

In this below table we be developing test cases to check the search function of word collection page.

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result
121	Check weather the given input word exist or not	<ol style="list-style-type: none"> 1. Go to site https://bangla-spell-checker-diu.herokuapp.com/collection/ 2. Enter the word which you want to search 	সাইমুন	সাইমুন Will be shown into the list.

Table : 1.4 Test Case

5.4 TEST RESULT

The given table below is showing the testing result for Spell Check

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Pass / Fail
1	Check User input word is correct or not	<ol style="list-style-type: none"> Go to site https://bangla-spell-checker-diu.herokuapp.com/ Enter the word which you want to check if its correct or not Click Check Button 	আমরা	Correct message will be shown.	Correct	Pass
2	Check User input word is correct or not	<ol style="list-style-type: none"> Go to site https://bangla-spell-checker-diu.herokuapp.com/ Enter the word which you want to check if its correct or not Click Check Button 	মানুষ	Wrong Suggested Word Will be shown	Wrong. Suggested word Showed	Pass
3	Check User input word is correct or not	<ol style="list-style-type: none"> Go to site https://bangla-spell-checker-diu.herokuapp.com/ Enter the word which you want to 	হাত	Correct	Correct	Pass

		check if its correct or not 3. Click Check Button				
4	Check User input word is correct or not	1. Go to site https://bangla-spell-checker-diu.herokuapp.com/ 2. Enter the word which you want to check if its correct or not 3. Click Check Button	Amra	Wrong and suggested word will be shown	Wrong and suggested word Showed	Pass

Table : 1.5 Test Result

Now the given table below is showing the test result of Add words

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Pass / Fail
111	Add a word to the dataset	1. Go to site https://bangla-spell-checker-diu.herokuapp.com/add_word/ 2. Enter the word which you want to Add. 3. Click the add button	সাইমুন	সাইমুন Added Successfully	সাইমুন Added Successfully	Pass

Table : 1.6 Test Result

Now the given table below is showing the search function test result :

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Pass / Fail
121	Check weather the given input word exist or not	<ol style="list-style-type: none"> Go to site https://bangla-spell-checker-diu.herokuapp.com/collection/ Enter the word which you want to search 	সাইমুন	সাইমুন Will be shown into the list.	সাইমুন is showing into the list.	Pass

Table : 1.7 Test Result

CHAPTER 6

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

6.1 IMPACT ON SOCIETY

Language is an important thing to every society, nation and also to the people of the country. Language is represented in two ways; one is speaking and the other one is writing. Writing is the documented part of a language. When we write anything it's the way to represent our language and therefore spelling of every word, sentence is also a very important part of our language. Error free spelling is always wanted by all of us. As our national language is Bangla. So, it is very much important to have good knowledge in Bangla spelling. We always use Bangla for different purposes and we make mistakes on spelling and don't know the correct spelling and face problems in various cases. For this reason, our project "Bangla Spell Checker" is going to put a great impact on our society and the people of our society. Our spell checker is going to help people to make their spelling correct and make their desired documents spelling error free. They can check their spellings and see the suggested correct words from our project. We always need to use Bangla in our applications to government offices and also in our educational institutions. We also have our property documents all written in Bangla. Those are very sensitive issues. A slight spelling mistake can make us suffer. So if they use our Spell checker then they can get read of this problem. And there is no Bangla spell checker available so they can be helpful by using our project. And finally, the people of our society can learn the accurate spelling of Bangla works which is also an important matter as a Bengali.

6.2 IMPACT ON ENVIRONMENT

We can't say that we have direct impact on environment, but as we know the culture of a nation is often related to it's environment so in that way, we have a good impact in environment too. On the other hand, culture is a part of our environment. And one of our most important and ancient culture is our language Bangla. It is the language we are using

from hundreds of years ago. Our spell checker will ensure people to use the language with correct spelt words while they use it. Moreover, they will learn the correct spelling and as they get to know the right spelling of every Bangla words they will represent good things about our culture. People around the world will get to know that our people are very much possessive about our language and they try respect their culture as well. So, our spell checker can also have a good impact on our environment as well by representing our language error free use of general people through our Bangla spell checker.

6.3 ETHICAL ASPECTS

The ethical aspects of our project is to make people aware of the spelling errors. To learn and use the correct spelt words in their daily uses. We want that people can correctly spell their desired word when they are writing any type of documents that is important like; official documents, property related papers etc. And those are very sensitive issue so our motive is every user of our spell checker may avoid spelling errors when they are writing any type of documents.

6.4 SUSTAINABILITY PLAN

In this context we tried to identify the correct and incorrect words and show the suggestions for incorrect words by using different algorithms. The work of our project is not going to stop here and have a future plan with this work. In future we are going to apply several algorithms and work on the logical part. We are going to make and develop the project so that if we give an input of a paragraph, it can identify errors from the paragraphs and correct them. We have a plan to develop the project in such way that it can also find the grammatical errors of any content, line or paragraph and make the correction of those errors accurately. To develop an effective and suitable Spell Checker a lot of theoretical as well as practical studies are required. Theoretical studies need long time study with concentration and dedication. Group-work is also required. Practical study is expensive, requires a lot of sample documents collection, users' feedbacks collection, a huge amount

of data-entry and data-correction are required. A vast amount of investment in terms of time and money including mental efforts are required. At the first aspect of Bangla Sound tone, detection of Replacement, Deletion, Insertion and Swap error, possible formation of Minor error and its detection has been considered. Each aspect including the combination, need to be more optimized and precise. After all, a platform has been developed but that need to be further exercised. Spell check functions or spell checkers are software applications that check words against a digital dictionary to ensure they are spelled correctly. Words that the spell checker identifies as misspelled are typically highlighted or underlined. One main benefit of using a spell checker is its accuracy. Running a spell checker ensures that the number of typos in your document decreases significantly. Spell checkers can also save you a significant amount of time by correcting all instances of a misspelled word at once

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 DISCUSSION AND CONCLUSION

To develop an effective and suitable Spell Checker a lot of theoretical as well as practical studies are required. Theoretical studies need long time study with concentration and dedication. Group-work is also required. Practical study is expensive, requires a lot of sample documents collection, users' feedbacks collection, a huge amount of data-entry and data-correction are required. A vast amount of investment in terms of time and money including mental efforts are required. At the first aspect of Bangla Sound tone, detection of Replacement, Deletion, Insertion and Swap error, possible formation of Minor error and its detection has been considered. Each aspect including the combination, need to be more optimized and precise. After all, a plat-form has been developed but that need to be further exercised.

7.2 SCOPE FOR FURTHER DEVELOPMENT

In this project we used minimum edit distance algorithm which is also known as Levensthein algorithms and Django framework for run it into a webpage. Lately we hosted the project with Heroku. In future we have plan to build database to store more data. Now we are using a text document for storing data. We have also plan to expand the data set to get more efficiency. After all of this we also have some plan to add more features in this project. As there is no other Bangla spell checker available we have plan to expand the project. There is also some scope for adding more data in the dataset.

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APPENDIX

LVENSTHEIN ALGORITHM

Informally, the Levenshtein distance between two words is the minimum number of single-character edits (insertions, deletions or substitutions) required to change one word into the other.

DJANGO

Django is a high-level Python web framework that enables rapid development of secure and maintainable websites. Built by experienced developers, Django takes care of much of the hassle of web development, so you can focus on writing your app without needing to reinvent the wheel

HTML

HTML (Hypertext Markup Language) is the code that is used to structure a web page and its content. For example, content could be structured within a set of paragraphs, a list of bulleted points, or using images and data tables.

BOOTSTRAP

Bootstrap is a free and open source front end development framework for the creation of websites and web apps. ... In computers, the word bootstrap means to boot: to load a program into a computer using a much smaller initial program to load in the desired program (which is usually an operating system).

PLAGIARISM CHECK REPORT

5/1/2021 Turnitin Originality Report

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