

AUTOMATIC QUESTION AND ANSWER GENERATION FROM BENGALI AND ENGLISH TEXTS

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Abstract

The aim of this paper is to build a Question-Answering (QA) system considering Bengali and English language whose task is to generate questions along with their answers. There are two different process modules for Bengali and English. In each module, the main part is Question Generator (QG) which generates possible questions from a sentence by choosing a possible phrase as an answer-phrase. After that, the system has to perform some NLP tasks such as main verb decomposition, subject-auxiliary inversion (for English), replace answer-phrase with the question tag. Considering bivokti (বিভক্তি), postfix and singular-plural, we have to choose the proper question tag and their form in Bengali. The selected answer-phrase for a question is used as the answer to that question. Another task of this system is to store the generated questions and their valid answers. Finally, the questions and their answers are displayed on the screen. The performance and accuracy of the system are evaluated on different Bengali and English texts. The performance of the system on question generation is 78.33% compared to the human being and the average percentage of accuracy of the generated questions is 76%.

Keywords: Question Generator, NLP, Bengali-English, Answer-Phrase, Bilingual

1. Introduction

If we ask that whether any interactive computer system about Question-Answering (QA) exists, the answer will be yes. But still, it is not so much. If there is a system that one can test by auto-generating different types of effective questions from some given texts as well as the answers for those questions, then it may be obviously helpful for him/her. Moreover, if it is bilingual, it will be an effective work for students as they may have academic subjects in two different languages (for example, Bengali and English in Bangladesh). So our goal is to design a QA system for Bengali and English.

Generating raw questions along with answers can be a time consuming and effortful process. We have tried to do it here. Especially, the aim of the proposed system is to generate factual questions along with the answers from the texts. The system's heart is a Question Generator (QG) that takes plain texts and gives a set of factual questions with the answers. A user can then select and revise them to create practice exercises or part of a quiz to assess whether students read the text and retained knowledge about its topic. We have motivated using informational, non-fiction texts that have factual information rather than opinions. And of course, here our work is not too much expert to do this. That expertise belongs to the future task.

2. Literature Review

Now the world has a great eye on the field of Natural Language Processing (NLP). Someone do researches on text processing, others on text understanding, text summarizing, finding answers for given questions, and generating questions, etc. All of these tasks are a great deal with NLP. Some of the works that are done earlier on question generation are listed below.

Hitomi *et al.* [1] concerned with a type of infant bilingualism in which children have been regularly exposed to two languages from birth as a result of each of their parents speaking in a different language. Their system produces the only negative question in both Japanese and English language and judges the user's response.

Xu *et al.* [2] focused on the methods for question generation and answer judging as well as the game implementation. Here they worked with Chinese and English statements. A cross-language QA system was developed by Plamondon *et al.* [3]. Here they developed a system that receives questions in English language and shows the answers in English for the texts in English. They also transformed the system into a bilingual system to allow French speakers to ask their questions in French and get answers in French as well but using an English document collection. Kaur *et al.* [4] described a system that first collects the corpus of data or paragraph from the encyclopedia to make the questions and find the exact answers.

Plamondon *et al.* [5] developed a system where the question must be asked in English, the document collection was in English and the answer extraction was performed in English. Filho *et al.* [6] developed a system where they tried to classify the questions in only four types ("who", "where", "when" and "how many" questions).

Sharma *et al.* [7] developed a system on automatic generation of questions from the given paragraph in Punjabi language and also the system would generate the multiple choice questions from the generated questions. Generation of multiple choice questions is very important because this helps anyone to test their knowledge in the specific field. One can give the answer easily by choosing one option from a given set of options provided by the system and then the system evaluates the given answer and generates the result for all of the given answers. Various Punjabi language-dependent rules and examples have been developed to generate the output based on the given input. The questions would be generated by the proposed system on the basis of these rules and examples. The system would use rules-based approach, pattern matching, and information extraction. The rules were made according to some keywords like "names", "location names", "dates", "years", etc. A corpus in the Punjabi language was also created which find the named entities for the names of persons, cities, places, etc.

A few Bengali and English question answering system is also developed. Haque *et al.* [8] developed a question answering system based on transliteration and table look-up as an interface for the medical domain. The system is in no way a complete QA system; however, it gives a basis to implement a complete QA system for Bengali. The implementation was involved with the generation of questions from the medical domain only. They also considered only simple questions ('Wh' questions).

Pakray *et al.* [9] developed a keyword based multilingual restricted domain question answering system with dialogue management for railway information in Bengali and Telugu. The system accepted typed text inputs and provided text output as well. Hoque *et al.* [10] proposed a framework for generating questions and corresponding answers considering the documents of two different languages- Bengali and English. But this can only generate simple 'Wh' questions. Banarjee *et al.* [11] demonstrated a system that ensemble of multiple models achieved satisfactory classification performance in the task of question classification.

3. The System Model and Methods

The model and the workflow of the proposed QA system are described in the following sections. We have worked on two different procedures to solve the problem for Bengali and English in a different way. It has four basic modules such as (a) Input module, (b) English module, (c) Bengali module, and (d) Output module. The architecture is shown in Figure 1.

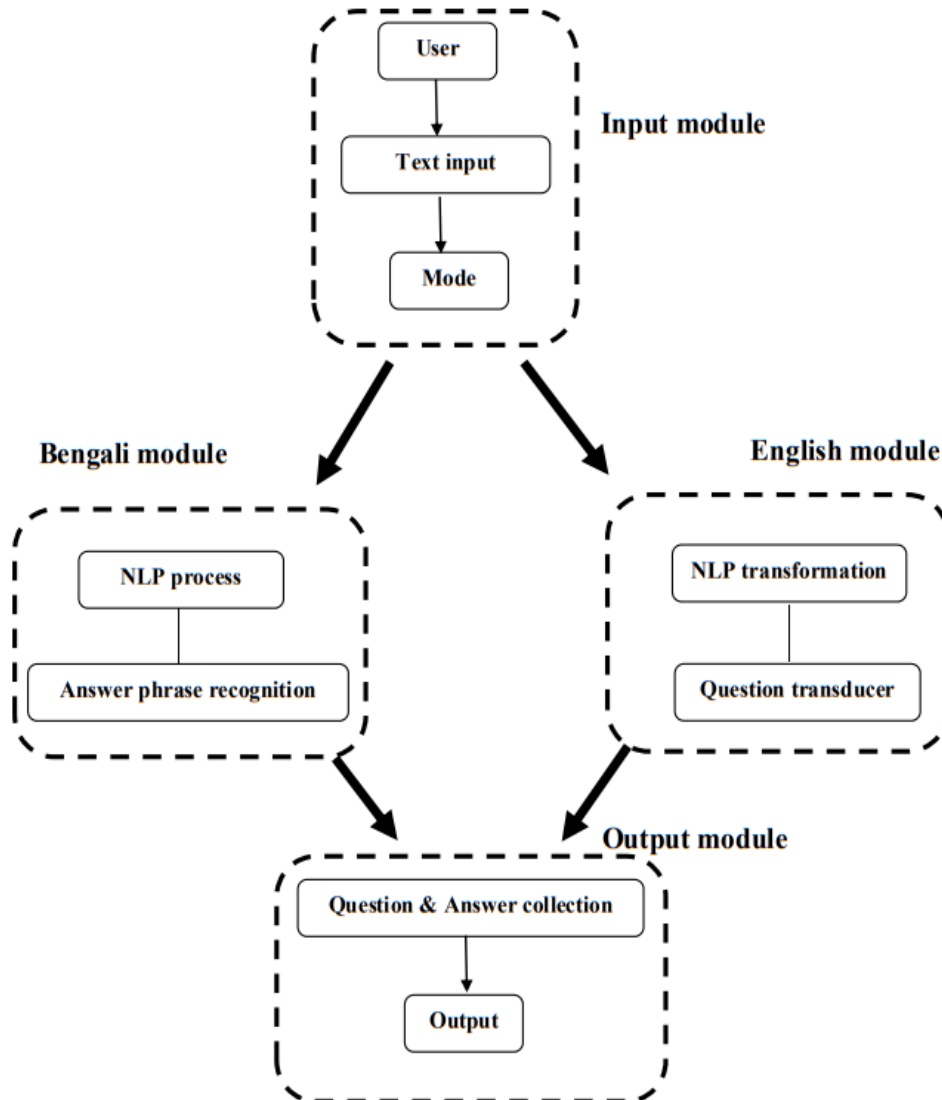


Figure 1: The System Model

3.1 Input Module

It takes the texts and language option as input from the user. The language option is either Bengali or English. It's another task is to select the mode for further processing based on language option.

3.2 English Module

In this module, basically, we have followed the procedure described by Heilman *et al.* [12] which is explained in this section. Here this procedure is modified slightly. This module deals with the Question Generator (QG) for English that defines a two steps process for question generation: (i) NLP Transformation and (ii) Question Creation. In step (i), the text sentences are transformed

into simpler straightforward declarative statements. This is done by applying some syntactical and grammatical operations. It has operations for transforming complex sentences into simple sentences and resolution of pronouns. In step (ii), these generated sentences are processed to generate questions by following some operations (Wh-movement, subject-auxiliary inversion, etc.). Here we have used some NLP tools to analyze the input sentences. The Stanford Core NLP tool is used to auto sentence split, tokenize, and parse sentence resulting in Penn Treebank style. We have also used the Parts of Speech (POS) tagger which labels the words of a sentence as their POS. It also labels the proper nouns with their semantic classes (often just person, organization, and location). All of these are implemented in the Stanford Core NLP tool.

3.1.1 NLP Transformation of Input Sentences

This step represents the first part of the QG. The English Grammatical rules are applied for transformation of complex sentences into simple sentences on the input text sentences if necessary. Then the pronoun replacement has been applied.

So, the first task is to extract simplified statements. Sometimes sentences contain many individual parts such as “*We, the students of your school, are fully responsible for this*”. This is extracted to “*We are fully responsible for this*”. Three subtasks are followed to accomplish the goal. They are:

- (i) **Removal of Stop Words and Relative Clauses:** The words whose absences don’t make any significant change in the sentence are called the stop words. And the clause which contains the relative pronouns at the beginning is called the relative clause. We can simplify many sentences by removing these unnecessary parts. For example, from the sentence “*However, they, who are the students of your school, want to do it*”, we can remove the word ‘*however*’ and the relative clause ‘*who are the students of your school*’ to transform into “*They want to do it*”.

<pre> Proc simpleSentenceExtract(<i>tree</i>) begin if <i>tree.firstChild.label</i> is <i>PP</i> then move <i>tree.firstChild</i> as <i>tree.lastChild</i> end if replace <i>tree</i> with extractDFS(<i>tree</i>) end Proc </pre>	<pre> Proc extractDFS(<i>tree</i>) begin if <i>tree.firstChild</i> is <i>NULL</i> then return end if if <i>tree.firstChild.label</i> is <i>WP</i> or <i>WP\$</i> then delete <i>tree.firstChild</i> from <i>tree</i> else if <i>tree.weight</i> is equal to 1 and <i>tree.leafValue</i> is in <i>stopWordList</i> then delete <i>tree.firstChild</i> from <i>tree</i> end if extractDFS(<i>tree.firstChild</i>) end Proc </pre>
(a)	(b)

Figure 2: The Extraction Algorithm (a) Primary Method, (b) Secondary Method

- (ii) **Splitting Conjunctions:** We split conjunctions between clauses and verb phrases. For example, we split the sentence, “*Nepal, Bhutan and China are located near Bangladesh but do not share a border with it*” as “*Nepal, Bhutan and China are located near Bangladesh*” and “*Nepal, Bhutan and China do not share a border with it*”. The extraction algorithm is given in Figure 2. There are two methods in this algorithm where the main

method takes a parse tree of a sentence as input and gives a set of the parse tree of simplified sentences as output.

- (iii) **Pronoun Replacing:** If the extracted simplified sentences contain any pronoun, then the generated questions may not be perfect. So we have tried to replace the pronouns with the antecedent nouns. For example, “*Bangladesh is a country in South Asia. It shares land borders with India and Myanmar*” contain pronoun ‘*it*’. So, the second sentence will be transformed into “*Bangladesh shares land borders with India and Myanmar*”. This is pronoun replacing. The algorithm is shown in Figure 3.

```

Proc pronounReplace(sentenceList, tokenList)
begin
for each sentence in sentenceList
  for each token in tokenList
    S = {location, time, organization, etc.}
    if token.posTag is person or is in S then
      store all the continuous persons in vector pers
      store all continuous non-person named entity in another vector nonPers
    else
      stop inserting token into its vector.
    end if
    if token.posTag is pronoun then
      if token is personalPronoun then
        replace token with pers
      else
        replace token with nonPers
      end if
    end if
  end for
end for
end Proc

```

Figure 3: The Pronoun Replacement Algorithm

3.1.2 Question Creation

After completing the NLP transformation, we have followed the following steps:

- (i) Answer phrase selection and generation of question phrases for the selected answer phrase,
- (ii) Main verb decomposition,
- (iii) Subject-auxiliary inversion, and
- (iv) Replacement of answer phrase with question phrase and placing at the beginning of the sentence.

These steps are shown in Figure 4.

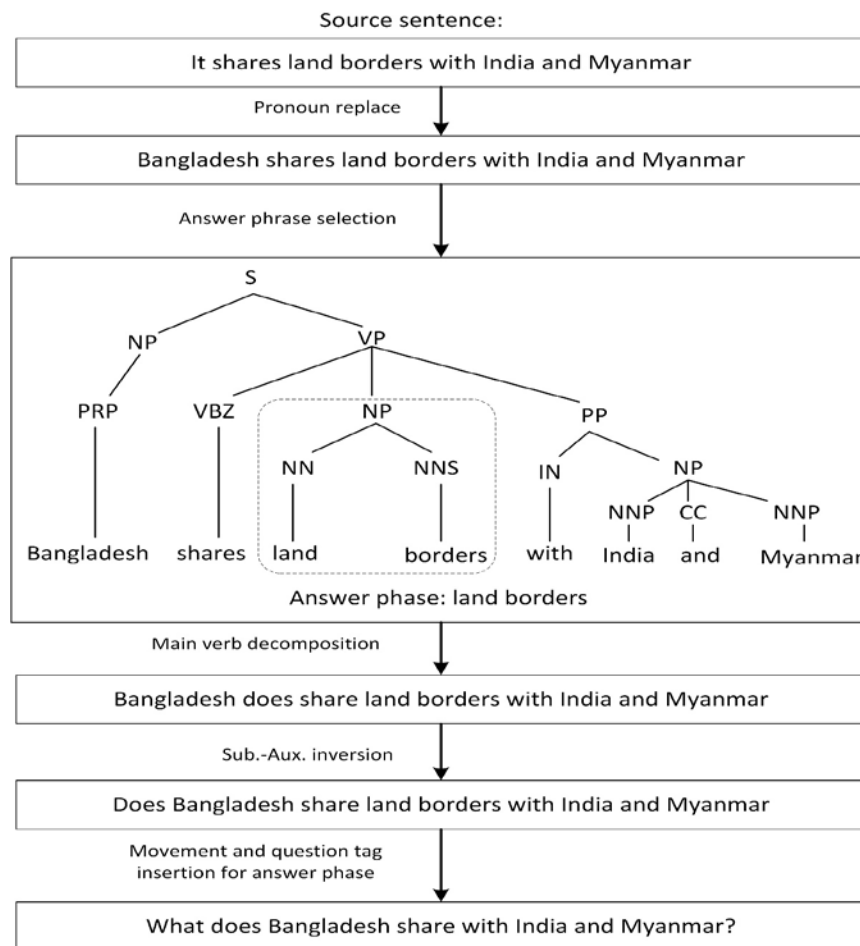


Figure 4: The Steps of Question Generation from English Sentences

The proposed system selects a noun phrase (NP) or prepositional phrase (PP) as answer phrase. This step is skipped for yes/no type questions since they have no question phrase. The algorithm for this is shown in Figure 5.

```

Proc selectAnsPhrase(tree)
begin
  if tree.firstChild.label is NP or PP then
    store ansPhrase as tree.firstChild
  end if
  selectAnsPhrase(tree.firstChild)
end Proc

```

Figure 5: The Answer Phrase Selection Process

If an auxiliary verb or modal is not present, the system changes the main verb into the appropriate form of do and the base form of the main verb and the algorithm is supplied in Figure 6. Now, the subject-auxiliary inversion is needed to generate grammatically correct questions. In questions, the auxiliary verb is located before the subject. So, we need to identify the subject and auxiliary verb and invert them. Now, the remaining steps are 'Answer Phrase Removal' and 'Question Phrase Insertion'. In this step, we have following Table 1. The table specifies the question phrase for each selected answer phrase. In the case of yes/no type questions, this step is not needed.

```

Proc decomposeMainVerb(tree)
begin
  if tree.label is VP then
    if tree.hasChild.label is VBZ then
      aux is “does”
      replace tree with lexeme(tree.label)
      insert aux before tree
    else if tree.hasChild.label is VBD then
      aux is “did”
      replace tree with lexeme(tree.label)
      insert aux before tree
    else if tree.label is VB then
      if lexeme(tree.label) is not equal to tree.label then
        aux is equal to tree
      else
        aux is equal to “do”
        insert aux before tree
      end if
    else if tree.label is MD
      aux is equal to tree
    end if
    return
  end if
  decomposeMainVerb(tree.firstChild)
end Proc

```

Figure 6: The Method of Main Verb Decomposition

Table 1: Mapping of Answer Phrase to Question Phrase

WH Word	Conditions	Examples
Who	Person or personal pronoun (I, he, herself, them, etc.)	Abdul Quaium, he, etc.
What	Object (not person or time)	Mountain, book, etc.
Where	Location preceded by the preposition (on, in, etc.)	in Bangladesh
When	Time, month, year, day or date	Wednesday
How many	Cardinal (CD) or quantifier (QP) phrase	5 taka
Whose	Noun with a possessive ('s or ')	Rahim's book

3.3 Bengali Module

Like English module, there is also a module of Question Generator (QG) for Bengali. We have generated Bengali questions in a different way from English. But still, some parts are same as before.

After preprocessing (sentence splitting, tokenization) of the text, we have to do NLP transformation (simple sentence extraction as before) and question generation from person, name entity, time, etc. But it is not needed to decompose main verb and subject-auxiliary inversion. We just need to replace the answer phrase with the proper question phrase. The step by step process of generating questions from Bengali text is illustrated in Figure 7 with an example.

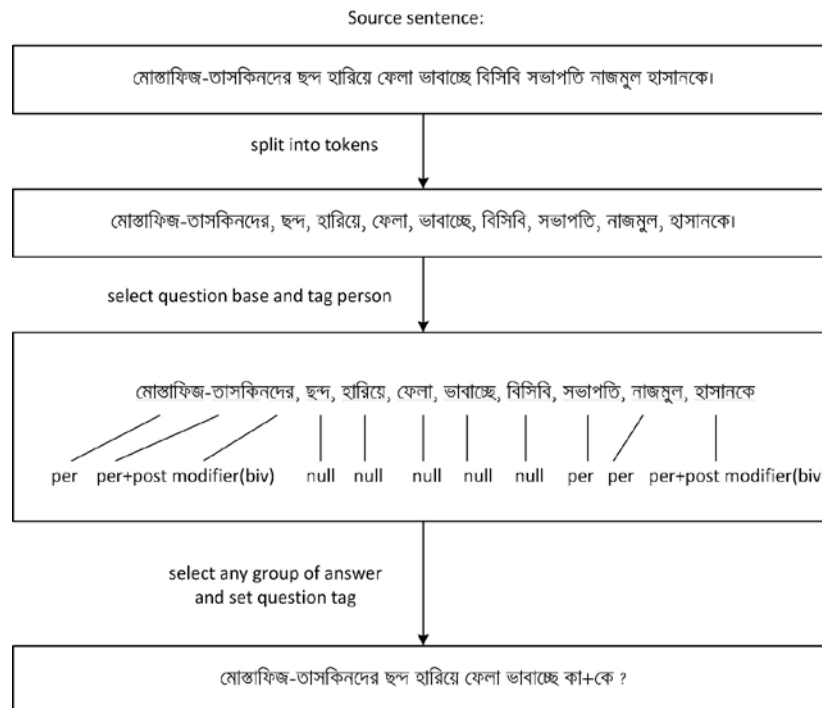


Figure 7: Steps of Question Generation from Bengali Sentences

3.3.1 Simple Sentence Extraction

First, the complex and compound sentences are transformed into simple sentences. But there are many rules to do it. Here only a few rules have been used. The rests are kept for future development. For example, there is a complex sentence “যদি কোন এলাকা প্লাবিত হয়ে ক্ষতি হয়, তবে বন্যা হয়েছে ধরা হয়”. Now we have to remove the subordinate clause marker and the finite verb should be changed as “VR (verb root) + লে”. The remaining is the same as before. Another example is “পশুপাখির জীবন বিনষ্ট হয় এবং সম্পদ ধ্বংস হয়”. Since this is a compound sentence, it is needed to remove the conjunction and store as different sentences.

3.3.2 Named Entity, Number, Time Recognition

After splitting into tokens, we choose different bases for question (person, number, time, etc.). To select token or a series of tokens as persons (নাম), it is needed to do some tasks:

- (i) While searching in the token list of a sentence, all the continuous persons are stored in a vector named *vecP*.
- (ii) If a token is found that is not a person and not a ‘,’ or ‘এবং’, then we stop inserting that token into *vecP*. At this stage, we check whether the last inserted person has a ‘Biv’ (বিভক্তি) or not. If no, then the question word is “কি” depending on from starting of the sentence whether we get the “নাম”. If the “নাম” is not found, then the question word is “কে”.

- (iii) If the *vecP.size()* is greater than one, then the question word should be কে কে or কি কি as shown in Table 2.

In case of number and time detection, we have followed the same procedure.

(i) In detection of number, we check a Regular Expression $(0-9)+.(.)(0-9)+.(-) 0-9)+.(.)(0-9)+$ for any number (e.g., 45, 375.95) or a range of number (e.g., 45-50, 6.4-3.4).

(ii) In detection of time, we check a Regular Expression $(0-9)+.(./|/)(0-9)+.(./|/)(0-9)+$ for general date format in Bengali.

- (iii) Then the question word is taken according to Table 2.

Table 2. Question Words for Different Tags

Tag	Question Word	Case
Person	কে	<i>vecP.size()</i> = 0 and 'Biv' is null and not found 'নাম'
Person	কি	<i>vecP.size()</i> = 0 and 'Biv' is null and found 'নাম'
Person	কা + Biv	Biv is not null
Person	কে কে	<i>vecP.size()</i> > 1 and 'Biv' is null and not found 'নাম'
Person	কি কি	<i>vecP.size()</i> > 1 and 'Biv' is null and found 'নাম'
Time	কখন	
Number	কত	
Location	কোথায়	

3.4 Output Module

This module just presents the generated questions along with their answers in a GUI. There is nothing else to do here.

4. Experimental Result

In this section, the performance of the proposed system is checked using some Bengali and English texts as input. A list of some of these texts is given in Table 3.

Table 3. Input Texts in Bengali and English

Title of the Text	Contents	Language
Cricket Team	২০১৫ সাল বাংলাদেশ ক্রিকেটের স্বর্ণ যুগ ছিল। কিন্তু ২০১৭ সালে ছন্দ হারিয়ে ফেলে। মাশরাফি বিন মুর্তজার নেতৃত্বে বাংলাদেশের পেস বোলিং আক্রমণে নতুন যুগ শুরু হয়েছে গত দুই বছরে। এতে অন্যতম ভরসা হলেন মোস্তাফিজুর রহমান ও তাসকিন আহমেদ। কিন্তু চ্যাম্পিয়নস ট্রফি থেকে দক্ষিণ আফ্রিকা তাদেরকে হতাশ করেছেন। মোস্তাফিজ সফর অসমাপ্ত রেখেই দেশে ফিরেছেন। তাসকিন পাননি বলার মতো সাফল্য। মোস্তাফিজ-তাসকিনদের ছন্দ হারিয়ে ফেলা ভাবাচ্ছে বিসিবি সভাপতি নাজমুল হাসানকে। শুক্রবার গুলশানে নিজ বাসভবনে সংবাদমাধ্যমের সামনে নাজমুল বাংলাদেশের পেস বোলারদের পারফরম্যান্স বলেন। রুবেল-মাশরাফিরা ঠিক বোলিং করছে। সমস্যা হচ্ছে দুইজন বোলারকে নিয়ে। গত চার বছরে মোস্তাফিজ-তাসকিনরা আমাদের গুরুত্বপূর্ণ ব্রেকথ্রু এনে দিয়েছে। মোস্তাফিজের হাটুতে ২ বার অস্ত্রোপচার হয়।	Bengali

Bangladesh	Bangladesh is a country in South Asia. It shares land borders with India and Myanmar. Nepal, Bhutan and China are located near Bangladesh but do not share a border with it. The country's maritime territory in the Bay of Bengal is roughly equal to the size of its land area. Bangladesh is the world's eighth most populous country. Dhaka is its capital and largest city. Chittagong has the country's largest port.	English
Flood	বাংলাদেশের প্রাকৃতিক দুর্যোগের মধ্যে বন্যা অন্যতম। যদি কোন এলাকা প্লাবিত হয়ে ক্ষতি হয়, তবে বন্যা হয়েছে ধরা হয়। বাংলাদেশ একটি নদীমাতৃক ও বৃষ্টিবহুল দেশ। এখানে বার্ষিক বৃষ্টিপাতের পরিমাণ ২৩০০ মিলিমিটার। ৫৭টি আন্তর্জাতিক নদীসহ ৭০০টি নদী এ দেশে জালের মতো বিস্তার করে আছে। এর মধ্যে ৫৪টি নদীর উৎসস্থল ভারতে অবস্থিত। বাংলাদেশে বন্যার ক্ষয়ক্ষতি ব্যাপক। বন্যায় ফসলের ক্ষতি হয়। মানুষের মৃত্যু এবং জীবনযাত্রা ব্যাহত হয়। পশুপাখির জীবন বিনষ্ট হয়। ধ্বংস হয় সম্পদ। ২০০০ সালের বন্যায় দেশের ১৬টি জেলার ১৮৪০০ হেক্টর জমির ফসল নষ্ট হয়। উৎপাদন হিসেবে এ ক্ষতির পরিমাণ ৫২৮০০০ মেট্রিক টন।	Bengali
Nawab Sirajuddoula	সিরাজ-উদ-দৌলার জন্ম ১৭৩৩ সালে। নবাব সিরাজ-উদ-দৌলা ছিলেন বাংলার নবাব আলীবর্দী খান-এর নাতি। আলীবর্দী খানের কোন পুত্র ছিল না। তাঁর ছিল তিন কন্যা। তিন কন্যাকেই তিনি নিজের বড়ভাই হাজি আহমদ-এর তিন পুত্রের সাথে বিয়ে দেন। আমেনা বেগমের দুই পুত্র ও এক কন্যা ছিল। পুত্ররা হলেন সিরাজ-উদ-দৌলা এবং মির্জা মেহেদী। আলীবর্দী খান যখন পাটনার শাসনভার লাভ করেন, তখন সিরাজ-উদ-দৌলা-এর জন্ম হয়। তিনি সিরাজের জন্মকে সৌভাগ্যের লক্ষণ হিসেবে বিবেচনা করে আনন্দের আতিশয্যে নবজাতককে পোষ্যপুত্র হিসেবে গ্রহণ করেন। সিরাজ তার নানার কাছে ছিল খুবই আদরের। তিনি মাতামহের স্নেহ-ভালোবাসায় বড় হতে থাকেন। সিরাজ-উদ-দৌলা ১৭৩৩ সালে জন্মগ্রহণ করেন। মীরজাফর তার কোন আত্মীয়ের মাঝে পড়েন না। কাজী ইসা তার চাচা হন।	Bengali
UN	The United Nations is an intergovernmental organization tasked to promote international cooperation and to create and maintain international order. A replacement for the ineffective League of Nations, the organization was established on 24 October 1945 after World War II with the aim of preventing another such conflict. At its founding, the UN had 51 member states; there are now 193. The headquarters of the UN is in Manhattan, New York City, and is subject to extraterritoriality. The organization is financed by assessed and voluntary contributions from its member states.	English

4.1 Question Generation Task

The number of generated questions by human and the proposed system for the texts listed in Table 3 is provided in Table 4. On the basis of the number of generated questions, we have evaluated the performance of the proposed system. A comparison chart between human and the proposed system on question generation is also shown in Figure 8.

Table 4. Number of Generated Questions by Human and the QA System

Title of the Text	No. of Questions Generated by Human	No. of Questions Generated by the Proposed System
Cricket Team	28	20
Bangladesh	18	26
Flood	24	15
Nawab Sirajuddoula	28	17
UN	22	16

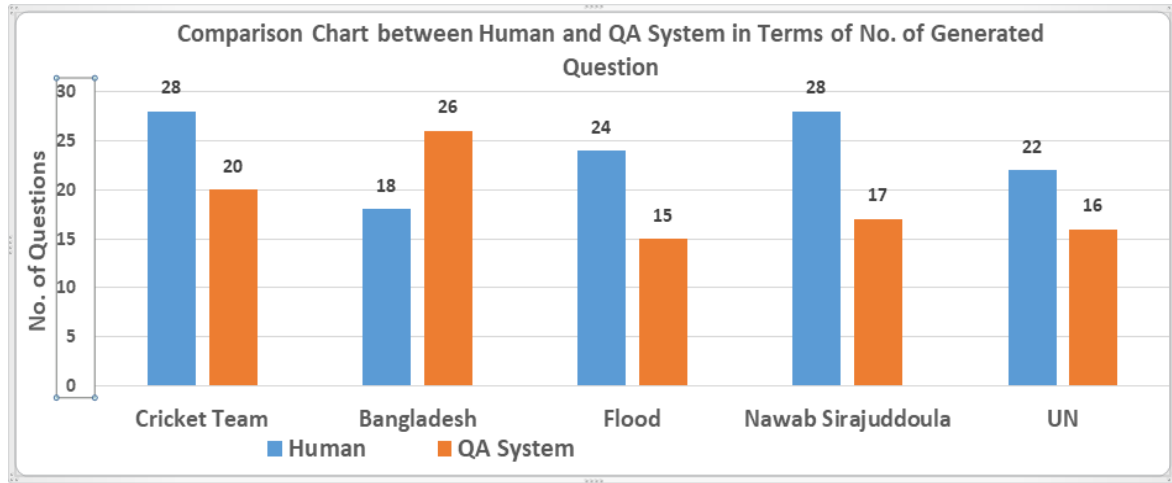


Figure 8: A Comparison Chart between Human and the QA System on Question Generation

The average number of questions generated by human is $(28 + 18 + 24 + 28 + 22) / 5 = 24$ and the proposed QA System is $(20 + 26 + 15 + 17 + 16) / 5 = 18.8$. So, the performance of the QA system on question generation is $(18.8 / 24) * 100\% = 78.33\%$ compared to the human.

4.2 Correctness Analysis of Generated Questions

The generated questions are not always correct (grammatically or syntactically). Here we have analyzed the system on 10 randomly selected questions generated from the texts listed in Table 3. The correctness analysis of the selected questions is given in Table 5, Table 6, Table 7, Table 8, and Table 9.

Table 5. Correctness Analysis of the Generated Questions from the 'Cricket Team' Texts

Questions Generated by the QA System	Correctness
কত সাল বাংলাদেশ ক্রিকেটের স্বর্ণ যুগ ছিল?	Ok
কিন্তু কত সালে ছন্দ হারিয়ে ফেলে?	No
মাশরাফি বিন মুর্তজার নেতৃত্বে বাংলাদেশের পেস বোলিং আক্রমণে নতুন যুগ শুরু হয়েছে গত কত বছরে?	Ok
সমস্যা হচ্ছে কতজন বোলারকে নিয়ে?	Ok
কার নেতৃত্বে বাংলাদেশের পেস বোলিং আক্রমণে নতুন যুগ শুরু হয়েছে গত দুই বছরে?	Ok
এতে অন্যতম ভরসা হলেন কে কে?	No
কাদের ছন্দ হারিয়ে ফেলা ভাবাচ্ছে বিসিবি সভাপতি নাজমুল হাসানকে?	Ok
কখন গুলশানে নিজ বাসভবনে সংবাদমাধ্যমের সামনে নাজমুল বাংলাদেশের পেস বোলারদের পারফরম্যান্স বলেন?	Ok
মোস্তাফিজের হাঁটুতে কত বার অস্ত্রোপচার হয়?	Ok

মোস্তাফিজ-তাসকিনদের ছন্দ হারিয়ে ফেলা ভাবাচ্ছে কাকে?	Ok
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Table 6. Correctness Analysis of the Generated Questions from the 'Bangladesh' Texts

Questions Generated by the QA System	Correctness
What shares land borders with India and Myanmar?	No
What does Bangladesh share with India and Myanmar?	Ok
What is roughly equal to the size of its land area?	Ok
What do Nepal, Bhutan and China not share with it?	Ok
What is the country's maritime territory in the Bay of Bengal roughly equal to?	Ok
Are Nepal, Bhutan and China located near Bangladesh?	Ok
What is Bangladesh?	Ok
What does Chittagong have?	Ok
Is Dhaka its capital and largest city?	Ok
What is the world's eighth most populous country?	No

Table 7. Correctness Analysis of the Generated Questions from the 'Flood' Texts

Questions Generated by the QA System	Correctness
কত সালের বন্যায় দেশের ১৬টি জেলার ১৮৪০০ হেক্টর জমির ফসল নষ্ট হয়?	Ok
এখানে বার্ষিক বৃষ্টিপাতের পরিমাণ কত মিলিমিটার?	No
বাংলাদেশ কি?	Ok
কতটি আন্তর্জাতিক নদীসহ ৭০০টি নদী এ দেশে জালের মতো বিস্তার করে আছে?	No
কতটি নদীর উৎসস্থল ভারতে অবস্থিত?	Ok
কিসের প্রাকৃতিক দুর্যোগের মধ্যে বন্যা অন্যতম?	No
২০০০ সালের বন্যায় দেশের কতটি জেলার ১৮৪০০ হেক্টর জমির ফসল নষ্ট হয়?	Ok
কোথায় বন্যার ক্ষয়ক্ষতি ব্যাপক?	Ok
২০০০ সালের বন্যায় দেশের ১৬টি জেলার কত জমির ফসল নষ্ট হয়?	Ok
কোথায় ফসলের ক্ষতি হয়?	No

Table 8. Correctness Analysis of the Generated Questions from the 'Nawab Sirajuddoula' Texts

Questions Generated by the QA System	Correctness
সিরাজ-উদ-দৌলার জন্ম কত সালে?	Ok
সিরাজ-উদ-দৌলা কত সালে জন্মগ্রহণ করেন?	Ok
কার জন্ম ১৭৩৩ সালে?	Ok
কে ছিলেন বাংলার নবাব আলীবর্দী খান-এর নাতি?	Ok
নবাব সিরাজ-উদ-দৌলা ছিলেন বাংলার কার নাতি?	No
কার কোন পুত্র ছিল না?	Ok
আলীবর্দী খানের ছিল কত কন্যা?	No
তিন কন্যাকেই তিনি নিজের কার তিন পুত্রের সাথে বিয়ে দেন?	No
কার ছিল তিন কন্যা?	Ok
কার দুই পুত্র ও এক কন্যা ছিল?	Ok

Table 9. Correctness Analysis of the Generated Questions from the 'UN' Texts

Questions Generated by the QA System	Correctness
Where is the headquarters of the UN?	Ok
What was the ineffective League of Nations?	Ok
What is in Manhattan?	Ok
What was established on 24 October 1945 after World War II in order to prevent another such conflict?	Ok
What was a replacement for the ineffective League of Nations established on 24 October 1945 after?	No
When was a replacement for the ineffective League of Nations established on 24 after World War II in order to prevent another such conflict?	Ok
What is the United Nations?	Ok
Did the UN have 51 member states at its founding?	Ok
How many member states did the UN have a replacement for the ineffective League of Nations, the organization's founding?	Ok
Is the organization financed by assessed and voluntary contributions from its member states?	Ok

The percentage of accuracy of the generated questions from the texts listed in Table 3 is 80%, 80%, 60%, 70%, and 90% respectively. These accuracy values are also plotted in Figure 9 to get the accuracy graph of the QA system.

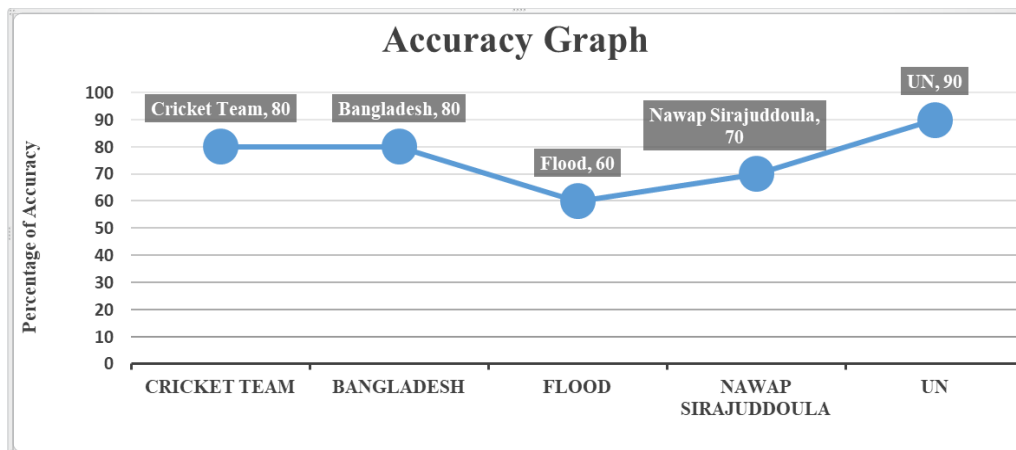


Figure 9. The Graph of the Percentage of Accuracy

5. Conclusion

There are many tasks on QA system and most of them are of monolingual. The bilingual or multilingual QA systems also exist. But the bilingual QA systems on Bengali and English are very few. Here we proposed a basic QA system for Bengali and English. It can generate questions along with their answers from both Bengali and English texts. It can also generate two types of questions such as true-false and short question. It is capable to generate questions which are more accurate both in grammatically and syntactically than the generated questions by the existing QA systems. The performance and accuracy of the system are evaluated by inputting different texts both in Bengali and English. We are able to increase the performance of the system up to 78.33% and the percentage of accuracy of the generated questions is 76% on average. The performance and accuracy of the system may be improved if the obvious shortage of Bengali resources and tools may be overcome.

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