Publications of the researcher related to this work

**International Journals**


**International conferences**


**National Conferences**


Appendix 1

Excerpts from Bilingual Dictionary

[ "അഗ്നി", "n","fire"],
[ "അഗ്രം", "n","edge"],
[ "അംഗം", "n","part"],
[ "അങ്കം", "n","fight"],
[ "അംഗന", "n","lady"],
[ "അംഗുലി", "n","finger"],
[ "അങ്ങാടി", "n","market"],
[ "അച്ചടക്കം", "n","discipline"],
[ "അച്ചാര്‍", "n","pickle"],
[ "അമ്മ", "n","mother"],
[ "അട", "n","cake"],
[ "അടക്ക്", "v","close"],
[ "അടക്കി", "v","suppressed"],
[ "അടപ്പ്", "n","lid"],
[ "അടയ്", "v","close"],
[ "അടക്ക", "v","arecanut"],
[ "അടിച്ചു", "v","beat"],
[ "അടിക്ക്", "v","beat"],
[ "അടുക്കള", "n","kitchen"],
[ "അടുപ്പ്", "n","stove"],
[ "അടുപ്പം", "n","closeness"],
[ "അണയ്", "n","millipede"],
[ "അണി", "n","army"],
[ "അണിയറ", "n","room"],
[ "അണു", "n","atom"],
[ "അച്ചന്‍", "n","father"],
[ "അച്ചിങ്ങ", "n","beans"],
[ "അണ്ണാന്", "n","squirrel"],
[ "അതിക്രമം", "n","attack"],
[ "അപ്പ്പാള്
condp","when"],
[ "അത്തര്
n","perfume"],
[ "അതയാഗ്ര
d,"greed"],
[ "അവിടട
tn","there"],
[ "അപ്േഹം
d,"he",H],
[ "അധികാരം
n","power"],
[ "അനത്ത്
v","heat"],
[ "അനന്തരം
n","afterwards"],
[ "അനിലന്
n","breeze"],
[ "ആര്പ്പ്
n","shouting"],
[ "ആല
tn","workshop"],
[ "ആലിംഗനം
n","hug"],
[ "ആപ്ലാചന
n","thought"],
[ "ആപ്വശം
n","spirit"],
[ "ആശങ്ക
n","doubt"],
[ "ആശയം
n","idea"],
[ "ആശാന്
condp","teacher",H],
[ "ആശാ
n","surprise"],
[ "ആശയാഗ്ര
d","support"],
[ "ആവരണം
n","covering"],
[ "ആവാഹിക്ക്
v","catch"],
[ "ആപ്പശം
n","asura",H],
[ "ആഹാരം
n","food"],
[ "അസുരന്
condp","asura",H],
[ "ആറ്
n","river"],
[ "ഇക്കിളി
n","tickle"],
[ "ഇംഗിതം
n","wish"],
[ "ഇഞ്ചി
n","ginger"],
[ "ഇട
tn","gap"],
[ "ഇടനാഴി
nn","corridoor"],
[ "ഇടയന്
condp","shepherd",H],
[ "ഇടിക്ക്
v","hit"],
[ "അണ്ണാന്
condp","when"],
[ "അതിക്രമം
n","attack"],
[ "അപ്പ്പാള്
condp","when"],
[ "അത്തര്
n","perfume"],
[ "അതയാഗ
d,"greed"],
[ "അവിടട
tn","there"],
[ "അപ്േഹം
d,"he",H],
[ "അധി�ാരം
n","power"],
[ "അന
tn","heat"],
[ "അനന്തര
tn","afterwards"],
[ "അനിലന്
n","breeze"],
[ "ആര
tn","hug"],
[ "ആപ്ലാചന
n","thought"],
[ "ആപ്വശം
n","spirit"],
[ "ആശങ്ക
n","doubt"],
[ "ആശയം
n","idea"],
[ "ആശാന്
condp","teacher",H],
[ "ആശ
n","surprise"],
[ "ആശയ
d","support"],
[ "ആവര
tn","covering"],
[ "ആവ
tn","catch"],
[ "ആപ്പ
tn","asura",H],
[ "ആഹ
tn","food"],
[ "അസു
condp","asura",H],
[ "ആറ്
n","river"],
[ "ഇക
tn","tickle"],
[ "ഇം
n","wish"],
[ "ഇഞ
n","ginger"],
[ "ഇ	n","gap"],
[ "ഇ
n","corridoor"],
[ "ഇ
condp","shepherd",H],
[ "ഇ
v","break"],
[ "അ
v","hit"],
[ "ഇണ" , "n" , "pair"],
[ "ഇണ്ഡാമാ" , "n" , "fuel"],
[ "ഇര" , "n" , "prey"],
[ "ഇരുട്ട്" , "n" , "darkness"],
[ "ഇല" , "n" , "leaf"],
[ "ഇഴയ്" , "n" , "liking"],
[ "ഇാക്ക്" , "n" , "moving"],
[ "ഇാവ്" , "n" , "concession"],
[ "ഇരവ" , "n" , "mov"],
[ "ഇായൂ" , "n" , "descend"],
[ "ഇാകാ" , "v" , "down"],
[ "ഇാപ്റ്റ" , "v" , "start"],
[ "ഇാവ്" , "n" , "strong"],
[ "ഇാറ്" , "n" , "rosewood"],
[ "ഇാത്യാ" , "n" , "tune"],
[ "ഇാത്" , "n" , "fly"],
[ "ഇാഥർബി" , "n" , "wetness"],
[ "ഇാഥി" , "n" , "anger"],
[ "ഇാടെണ" , "n" , "god"],
[ "ഇാടി" , "n" , "idea"],
[ "ഇത്ത" , "n" , "powerful"],
[ "ഇവ" , "pav" , "now"],
[ "ഇവാ" , "v" , "quarrel"],
[ "ഇവാ" , "v" , "dry"],
[ "ഇവാമാരു" , "n" , "owner"],
[ "ഇവ" , "n" , "dress"],
[ "ഇവാമളി" , "v" , "wake"],
[ "ഇവ" , "v" , "wear"],
[ "ഇവി" , "n" , "child"],
[ "ഇവാല" , "n" , "perfect"],
[ "ഇവാടം" , "n" , "responsible"],
[ "ഇവാടാ" , "n" , "product"],
[ "ഇവാടം" , "n" , "origin"],
[ "ഇവാടം" , "n" , "spirit"],
[ "ഇവ" , "n" , "stomach"],
[ "ഇവാടം" , "n" , "example"],
[ "ഇവാടം" , "n" , "job"],
[ "ഇവടങ" , "v" , "pushed"],
[ "നാം", "n","aim"],
[ "അരി", "n" ,"top"],
[ "അഭിജ്ഞ", "n","helpful"],
[ "അവശേഷി", "n","advice"],
[ "ഉറപ്പ്", "n","scoup"]
Appendix 2
Transliteration table

<table>
<thead>
<tr>
<th>അ   ആ   ഇ   ഈ   ഉ   ഊ   എ   ഏ   ഐ   ഒ   ഓ   ഔ  എം  മ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a   aa   l   ee   u   oo   e   E   ai   o   O   ou</td>
</tr>
<tr>
<td>m</td>
</tr>
<tr>
<td>ka   kha   ga   gha   nga</td>
</tr>
<tr>
<td>cha   chha   ja   jha   nga</td>
</tr>
<tr>
<td>Ta   Tha   Da   Dha   Na</td>
</tr>
<tr>
<td>Tha   thha   da   dha   na</td>
</tr>
<tr>
<td>Pa   pha   ba   bha   ma</td>
</tr>
<tr>
<td>ya   ra   la   va   Sa   sha   sa   ha   La   zha   Ra</td>
</tr>
<tr>
<td>nka   ncha   nta   ntha   mpa   n   l   R   L   N</td>
</tr>
</tbody>
</table>

The letters like ഥ, ദ, ധ are generated by the sequences thya, thva and thra respectively. ു is marked by z.

The geminated letters ക, ച, ഞ are generated by the sequences kka, chcha, ththa respectively.
Appendix 3
Sample outputs from the Parser

1. **Input:** (Raju took Meena’s pen)

Source Parse Tree:

```
S
   /\   /
  /
N        V
|       |
Raju     took
|
\       /  \\
ADJO     N
   |
NG       ADJA
   |
N        ADJA
|        pen
Meena
```

Target parse tree:

```
S
   /
  /
N
  |
Raju
|
\  /
ADJO
   |
NG
   |
ADJA
   |
N
   |
NG
   |
ADJA
   |
pen
   |
Meena
```

In the source parse tree the noun group(NG) chunk (Raju, Meena’s) is treated as an adjective which depends on the noun and not as NG which depends on the verb. This sentence also uses the transfer rule 4 to place the verb in position.
2. Input: രാമന്‍ കാട്ടില്‍ പായി (Seetha told that Raman had gone to forest)

Source parse tree:

Target parse tree:

This uses 3 transfer rules. 1) Rule no.2 to move the noun clause suffix marker എന്ന് to the beginning of the noun clause. 2) Rule no.7 to move the principal clause to the front. 3) Place the verb in the correct position in the noun clause.
3. **Input**: സീത രമണനാശം രവനനാശം രമണൻ രവനൻ (Seetha was happy when Raman killed Ravan)

Source parse tree:

```
CS
  /    \   
ADVC  S
    /\   /\ 
  NG  V  ADVCA N
     /\  /\ 
  N   V  N
        /\ 
      N  N
        /\ 
      NA NA
```

Target parse tree:

```
CS
  /    \   
S    ADVC
    /\   /\ 
  N   ADVCA N
     /\  /\ 
  V   V  N
     /\  /\ 
  Seetha was happy when Raman killed Ravan
```

This sentence needs 3 transfer rules 1) rule 1 to place the adverb clause marker to the front of the clause 2) rule 7 to place the main clause in the front 3) rule 4 to place verb in position in the adverb clause.
4. Input: രമാ തിയറ്റ് സീതയുടെ ചെറുന് (Seetha heard what Rama told)

Source parse tree:

![Source parse tree]

Target parse tree:

![Target parse tree]

This uses 2 rules: 1) rule 1 to place the adverb clause marker to the beginning of the clause 2) rule 7 to move the main clause to the front.
5. Input: രാമന്‍ രാവനനോട് രാവനന്റെ പുത്രം ചാരട്ടി (Raman killed Ravan and his son)

Source parse tree:

![Source parse tree diagram]

Target parse tree:

![Target parse tree diagram]

This uses rule 4 to place the verb in position.
6. **Input:** ന്യായം ന്‌ലാണ്‌ രാമന്‌ ഏറെക്കുറവ്‌ നൽകി സീതയിൽ‌ (Seetha was happy when Raman gave an umbrella to Seetha)

Source parse tree:

```
<table>
<thead>
<tr>
<th>CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
</tr>
<tr>
<td>ADV CA</td>
</tr>
<tr>
<td>S</td>
</tr>
<tr>
<td>ADV CA</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>PA</td>
</tr>
<tr>
<td>PA</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>NA</td>
</tr>
</tbody>
</table>
```

Target parse tree:

```
<table>
<thead>
<tr>
<th>CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
</tr>
<tr>
<td>ADV CA</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>seetha</td>
</tr>
<tr>
<td>was happy</td>
</tr>
<tr>
<td>ADV CA</td>
</tr>
<tr>
<td>S</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Raman</td>
</tr>
<tr>
<td>gave</td>
</tr>
<tr>
<td>NP</td>
</tr>
<tr>
<td>PA</td>
</tr>
<tr>
<td>PA</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>umbrella</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>to</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>seetha</td>
</tr>
</tbody>
</table>
```

This uses 2 rules: 1) rule 1 to place the adverb clause marker to the beginning of the clause 2) rule 6 to move the main clause to the front.
7. Input: രാമന്‍ സീതക്ക് കകാടുത്തുകുടി സീത കളഞ്ഞു (Seetha lost the umbrella which Raman gave)

Source parse tree:

Target parse tree:

The input is parsed erroneously as follows. The error occurs due to the condition that clauses should not overlap. Here the subject of the main clause overlaps with the adjective clause.
8. Input: The police thought that the thieves who stole the chain had gone to forest in night

Source parse tree:

Target parse tree:

This uses 5 transfer rules: 1) rule 2 to move the adjective clause marker to the beginning of the clause. 2) rule 6 to move the noun following the adjective clause in front of the adjective clause. 3) rule 7 to place the main clause in the front 4) rule 3 to exchange noun and case suffix 5) rule 4 to place the verb after subject in the main clause and the subordinate clause.
9. Input: मीरा अच्छी से बारें में काम किया (Meera did the job neatly)

Source parse tree:

Target parse tree:

This example uses rule 13 to place the verb of a verb group before the object in the sentence.
10. Input: രാമൻ തന്റെ മുട്ടൻ മാറ്റി (Seetha gave Raman’s umbrella to Mohan)

Sourse parse tree:

Target parse tree:

This uses two rules: 1) rule 4 to place the verb after the subject. 2) rule 3 to interchange the position of noun and case suffix.
11. Input: രമകുടത്തികലകെള്ളംതറയിപലക്കുകട്ടന്നോഴിച്ചപപാളകെഴ്‌ക്രഞ്ഞ്

Radha scolded Rama when she poured quickly the water in the pot to the floor

Source parse tree:

Target parse tree:

This uses 6 rules 1) rule 3 to exchange noun and adjectival marker. 2) rule 11 to exchange adjective with suffix “ile” and noun following it 3) rule 12 to exchange the verb and the adverb. 4) rule 1 to place the adverb clause marker to the front of the clause. 5) rule 4 to place the verb in position in the main clause and the subordinate clause 6) rule 6 to move the main clause to the front.