

CHAPTER VI

Addressing Complex Engineering Problems and Activities

6.1. Complex Engineering Problems associated with the thesis

The ranges of Complex Problem Solving (P1 – P7) that should be addressed in the program are given in Table 6.1.

Table 6.1: Range of Complex Engineering Problem Solving

Attribute	Complex Engineering Problem	
Depth of knowledge	P1	This thesis work needed the basics of natural language processing, including tokenization, part-of-speech tagging, syntactic parsing, and semantic analysis. Also need to know Bangla linguistics, including its morphology, syntax, and semantics, is crucial.
Range of conflicting requirements	P2	Dependency parsing models heavily rely on annotated data for training. Ensuring the quality of annotations is essential for building accurate parsers. Bangla language exhibits syntactic complexities such as morphological variations, compound words, and flexible word order. Challenges occur when more complex models achieve higher accuracy for resource-constrained Bangla language.
Depth of analysis	P3	For Bangla language, weighted fully connected graph from input sentence requires a lot of knowledge about Bangla sentence structure, grammar rules, its

		exceptional cases. Also to verify the output dependencies need depth of knowledge.
Familiarity	P4	Familiarity with Bangla Linguistics, dependency Parsing Algorithms (transition and graph-based), Evaluation Metrics and Standards, Bangla Text Corpora and Resources.
Extent of applicable codes	P5	applicable codes in thesis can vary depending on the specific focus of the research. It includes model evaluation, experimental setup and analysis, integration with NLP libraries
Interdependence	P7	The project consists of multiple interrelated sub-problems, such as algorithm selection and language characteristics, data annotation and model training, edge labeling according to language characteristics.

6.2. Complex Engineering Activities Associated with the Thesis

The ranges of Complex Engineering Activities (A1 – A5) that are addressed in the program are given in Table 6.2.

Table 6.2: Range of Complex Engineering Activities

Attribute	Addressing the Attributes of Complex Engineering Activities	
Range of Resources	A1	This thesis work includes various types of resources such as Bangla corpus, language processing tool tokenization, part-of-speech tagging. These tools may include open-source NLP libraries like NLTK, spaCy, BNLTP for Bangla, Flask for user interface.

Level of Interaction	A2	The project involved interaction at multiple levels, including data curation from public repositories, engagement with machine learning libraries, and collaboration with medical professionals for validation of the results. The interdisciplinary nature of the work required effective communication across different domains, from computer science to medical imaging.
Innovation	A3	Developing methods for domain adaptation to improve parsing performance in specific domains or genres of Bangla text. Introducing new evaluation metrics or benchmarks specific to Bangla dependency parsing to provide more fine-grained assessments of parsing performance.
Consequences for Society and the Environment	A4	This work helps the Bangla language to be used globally, helps computers to work in Bangla, enriches Bangla resources
Familiarity	A5	This project holds a well-established modified Edmonds algorithm, edge-labeling methodology and introduces a new evaluation technique.