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# Chapter 4

# The Proposed Framework

**Chapter 4: The Proposed Framework**

## 4.1 Introduction

The objective of this research is to provide aids for the instructors in extracting both constituents of the adaptive knowledgebase, namely, MLOs and the partial Concept Ontology. Instructors are used to designing full lectures explaining a certain topic. This is usually done in one of the two forms of a video or a PowerPoint representation. The instructor does his/her lecture design according to his/her own preferences. Of course, it would be much unusual task to him to think in pieces instead of thinking holistically. Therefore, this research is concerned with taking a full lecture and tries to split it into its constituent components of MLOs each is concerned about a single instructional role of the topic. Identifying the MLO should also be complemented by identifying its metadata attributes. On another dimension, the research addresses the extraction of the partial concept ontology as covered by the lecture, which will then incrementally update the global concept ontology of the specific knowledge domain. The annotated attributes are saved in the appropriate LOR while the partial ontology is integrated to the domain knowledge ontology.

**Diagram

Description automatically generated**

**Figure 7**: Objectives: MLOs Extraction with Metadata Identification and Partial Concept Ontology Generation.

## 4.2 Proposed Framework Overview

The proposed framework is designed to handle two main types of digital lectures, namely, the Video and PowerPoint Presentation lectures. The proposed framework considered two types of Video lectures, namely, Video lectures with associated PPT Presentation, and Video lectures without associated PPT presentation. In addition, it considers two types of PPT presentations, namely, the Referenced template presentations (suggested by this research) and the non-Referenced (Normal) PPT presentations. The proposed framework, As shown in Figure 8, has different MLO Extraction components, one for each lecture type, which are responsible for extraction MLOs from Video and PPT Presentation lectures. The “Learning Objects Metadata Annotator”, the component that is responsible for annotating the MLOs with their appropriate metadata (Concept, Instructional Role, MediaType and language). The “Incremental Ontology builder” component is responsible for building the partial concept ontology for lecture.

Diagram

Description automatically generated

**Figure 8**: High-level Architecture of the Proposed Framework.

The workflow of the proposed framework starts with extracting MLOs from PPT Presentation (the Reference template) using the “Reference PPT Learning Objects Extractor”, then the MLOs are analyzed and annotated with the appropriate metadata using the “Learning Objects Metadata Annotator”, which are then stored in the MLO repository along with their metadata information stored in XML (Extensible Markup Language) format. The “Ontology Extract component” builds the partial concepts Ontology using the standard Agenda from the Referenced template, both the micro-LOR and the Knowledge Ontology are incrementally expanded each time a new MLO is added to the repository.

For the Non- Referenced PPT Presentation, an algorithm is designed and implemented to convert Non-Referenced PPTs into Referenced templates, to be ready for manipulation similarly to the Referenced template. The extracted MLOs are then used by the “Non-Reference PPT Learning Objects Extractor” to extract the MLOs from the original Non- Referenced PPT.

For Video lectures with associated PPT File, the PPT MLOs are extracted using the “PPT Learning Objects Extractor” after converting the PPT File to its corresponding Reference Template. The unique video frames are extracted from the video lecture through some preprocessing steps. These unique video frames and the original PPT slides are then used by the “Video Frames to PPT Slides Mapping” to the identify timestamps of each slide. Therefore, both the PPT MLOs and the unique frames are used by the “Video Lecture Learning Objects Extractor” to extract the Video lecture Micro Learning objects. The Video lecture MLOs are then annotated with their appropriate metadata by the “Learning Objects Metadata Annotator” and then stored in MLO repository.

For Video lectures without an associated PPT presentation, the “Smart PPT Extractor” is designed and implemented to extract the presentation slides from the video lecture, which are then used to regenerate the corresponding missing PPT file. The generated PPT Presentation then follows the same steps as in the case of a Video with associated PPT file. Those PPT MLOs are then used by the “Video Lecture Learning Objects Extractor” to extract Video lecture Micro Learning objects from the original video lecture. The extracted MLOs are then annotated with “Learning Objects Metadata Annotator” and then stored in MLO repository.

## The Proposed Framework Assumptions:

This proposed solution assumes the following assumptions:

1. The PPT Presentation lecture contains an agenda slide and/or separator slides.
2. In case of a Video Lecture with PPT Presentation, the PPT slides should be the same slides as in the video lecture.
3. In case of a Video Lecture, the instructor’s speech explains the slide that is currently displayed.
4. No animation inside single slide, therefore, authors are recommended to use multiple slides for the animation purposes instead of embedding the animation inside the same slide.
5. The Title of any PPT slide has to change from slide to another, in order not to be considered as identical slides when removing slide duplication, especially that the algorithm currently manipulates the slide title for the differentiation between slides. Enhancement this algorithm via considering other elements in the slide is considered as a future work.