Automation Of Business Analyst Tasks (Generation Of UML Diagrams)

Kirolos Magdy Yassa, Mai Adel, Tony Shereen Shawky Riad, Radwa Ibrahim, Mariam Nader
Computer and Information Science, Software Engineering Department , Ain Shams University

Abstract

Unified Modelling Language UML diagrams are helpful for displaying the requirements of any proposed system and assist in system design from the perspective of the end user, stakeholders. UML diagrams are created after the gathering of requirements in the software analysis process. Due to the complexity of the UML diagrams technical capabilities, it takes a lot of time to draw these diagrams using current drawing tools, thus automated UML Diagrams generation tool is necessarily needed. This project goal is to build a Software tool for producing UML diagrams use case and class diagrams from user input in form of text files using natural language processing.

Introduction

Building software is a complex process that combines technical expertise, creativity, and problem-solving skills. It involves the development and implementation of a set of features so that user goals are satisfied. The software development life cycle (SDLC) is a crucial process in software engineering that involves several stages, including requirements gathering, design, implementation, testing, and maintenance. The design phase is particularly important .Because in this phase, designers manually generate UML Diagrams, for instance Use Case and Class diagrams, from previously collected Requirements to model the system and its functionality. The process of UML modeling has been observed to consume a significant amount of time, leading to inefficiencies and delays. This is due to that modeling process requires careful analysis and design.One of issues can arise is that the utilization of UML modeling can require a significant investment of time . Also another challenge that can arise is that UML modeling requires familiarity with the language and its various diagrams types .

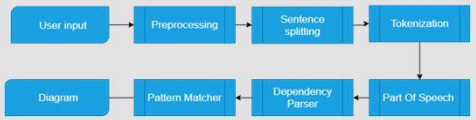
Design & Implementation

Front End
- Usage of React.js to create interactive UI.
- User registration and signing in forms .
- Displays generated class diagram , use case diagram
- Displays user's projects created after logging in .

Back End
- Input from user in text formated (.txt) files
- Saving file to firebase storage
- Usage of Spacy NLP library in preprocessing and analyzing text.
- Usage of fastapi python framework in building web application
- Plant-UML to render the text files into PNG format

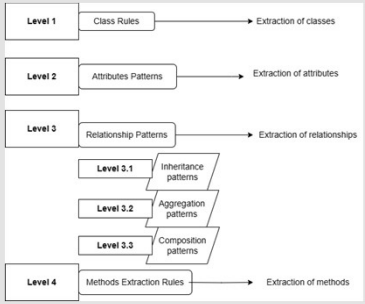
Methodology

Natural language processing pipeline



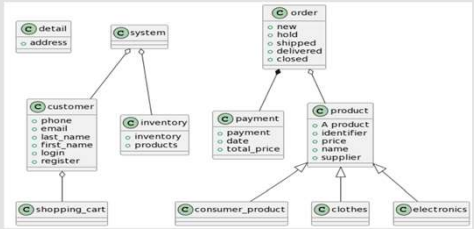
Use case diagram elements are extracted using dependency parsing tree . While class diagram elements are extracted by using Spacy pattern matcher and parts of speech and dependency tags .

Priority of class diagram elements extraction.

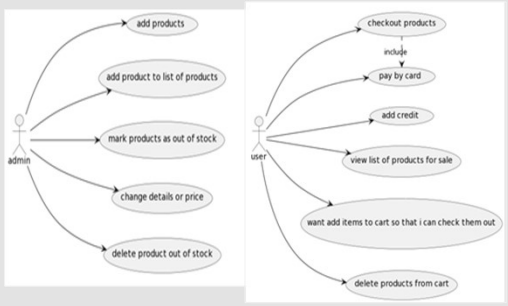


Results

UML Automation System allows user to register him self on system and upload his own files that includes user stories or functional requirements of system that he wishes to generate diagrams for .This system extract use case diagram elements as Actors and its associated use cases and relationships between use cases as "depends on relationship(include)"in order to generate a use case diagram in form of an image for user to download or view . As it also extract class diagram elements as classes and their attributes and relationships between classes from user input (functional requirement) in order to generate class diagram in form of an image.



UML Automation tool extract use case diagram elements with a recall value equals "85 %" and precision value equals "92 %" for systems with user stories less than 40 . While it can extract class diagram classes and elements with an average of recall value "75 %" and precision of average value "66.7%" .



Conclusion

Software design and analysis phase consume a lot of effort and time .this is due to the consuming resources in terms of time and effort in manually generating UML diagrams that can visualize the system to the stakeholders and developers of that system . On the other hand , automation has become one of the most important technologies nowadays . Thus , Automation of UML diagram generator is crucial. It is a automated tool that facilitates the generation of class diagram and use case diagram providing a user-friendly , secure web application for BAs to save , manage , and upload files to the their projects easily. Also, unlike other commercial software tools , "Automation of BA tasks " is an open- source Website for all users.

Finally ,this system offers its users the ability to save their time , effort and concentrate on more important tasks that cant be automated.

Future work

We hope to enhance our project and expand it by providing the following features and functionalities in Future works:
- Adding ML algorithms and models to extract more patterns.
- Extract methods of specific class.
- Adding multiplicity and cardinality ratio to relationship between classes in Class Diagram
- Easy and flexible User Edits to the Auto-generated Diagrams.
- Adding ML Unsupervised and semi-supervised models to Learn from manual User edits to the generated diagrams to enhance efficiency, accuracy, and performance.

References:

1. [UML]Object Management Group. Unified modeling language specification (2.1.1). Tech-nical report, Frammingam, Mass, 2007. http://www.uml.org.
2. Naik., A. a. ((2016).). *"Reflecting Natural Language Text in to UML Diagrams."*.
3. Universal POS tags. (2014-2022). Retrieved from Universaldependencies: https://universaldependencies.org/u/pos/