A RECOMMENDER SYSTEM USING CASE BASED REASONING ON LEADERSHIP ONTOLOGY

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Abstract: Preparation of Papers - These Bible which is the Holy Book for Christians contains instructions for life and has a vast reservoir of information useful for life. They are sufficient to provide an answer to queries on any vital topic in life. This project work focuses on 'Leadership', an important concept in life and aims to develop an Ontology for the same based on a few Books of the Old and the New Testaments of the Bible. Leadership is one of the vital personality traits that decide how much a person achieves and climbs up the ladder of success in life and influences other people and the society at large. The study on leadership can be done from various perspectives – Historical, Sociological, Psychological etc. but in this project work, it is approached from a Biblical perspective. In this work, the Biblical truths are used both to diagnose the leadership potential in a person and to recommend leadership scopes for a person based on his leadership abilities. For this, a combination of Ontological approach and Case-Based reasoning (CBR) is used. The OWL ontology on 'Leadership' is developed and used in the CBR system development. The CBR system is developed using myCBR. Any user can use this application to assess his leadership traits, recognize his eligibility for leadership and also receive Biblical recommendations to equip him for future leadership.

Keywords: Case Based Reasoning, Ontology, Recommender System.

Introduction: Biblical websites provide search engines that help users to do a keyword-based search on Biblical terms and list the verses that have those keywords. It is hard to correlate the verses and extract useful information because there is no established logical connectivity among them. An Ontology, based on the Biblical verses would enable structuring of the numerous verses which can then be queried upon to the user's benefit.

Role of Ontology on a Recommender System: Biblical websites provide search engines that help users to do a keyword-based search on Biblical terms and list the verses that have those keywords. It is hard to correlate the verses and extract useful information because there is no established logical connectivity among them. An Ontology, based on the Biblical verses would enable structuring of the numerous verses which can then be queried upon to the user's benefit.

Role of Case Based Reasoning (CBR) on a Recommender System: The CBR system stores details of past cases and their solutions in a CaseBase [1]. The user who has a new case for which he is seeking a solution can get suggestions from the CBR system as it calculates the similarity of the new problem with the repertoire of cases and solutions and projects a solution suitable to the new problem. One popular application of CBR systems is to develop a Recommender system which can serve a variety of user needs. The CBR system developed as part of this work stores the leadership criteria as given in the Epistles of the New Testament. The criteria include some characteristics [2] that are mandatory and a few characteristics that should not be present in a person in order to qualify for leadership. These eligibility criteria are stored in a CaseBase. The user of this system inputs his /her characteristics to allow the system to identify the leadership position suitable for him/her. This system integrated with the Ontology can efficiently answer simple and complex user queries and provide details beyond mere keyword-based retrieval.

Development of Recommender System: This work aims to develop a recommender system using Ontology based CBR system. The data is classified and structured conceptually using Protégé editor [3] and the Ontology is developed with all the instances. The CBR System is developed using myCBR (A

plug-in in Protégé Editor). The domain knowledge of the CBR system is in the form of Ontology [4]. The CBR system processes the input cases and gives an effective solution to the user. Leadership Recommender System aims to recommend the user the type of Leadership (King, Minister, Overseer, Pastor, Deacon, Elder, Husband and Prophet) that the user possess based on his Leadership traits. The case bases are taken from the individuals of Holy Bible [5]. The traits of the user, age and sex are given as the input to the recommender system which results a suitable Leadership type as the output based on the stored cases. Following are the steps in developing the recommender system

i)   Ontology development
ii)   Similarity Modeling
iii)   Retrieval Engine

Ontology development on 'Leadership': Ontology is a formal representation of concepts and the relationship between those concepts in a particular domain. Here the domain chosen is 'Leadership' from Holy Bible. Since we are interested only in the traits of Leaders [6], concepts such as sex and traits are considered. Each case of the CBR system is stored as the instance of a class. So it acts as the data base for the Recommender system. The Ontology is developed in Protégé editor 3.4.4. Table I gives the summary of the data used for developing the Ontology.

Table I: Summary of the data used for developing the Ontology

S.No.	Books from the Bible	No. of verses	Ontology
1	I Timothy, Titus, I Samuel, Proverbs, Leviticus, Ezra, II Chronicles, [6]	109	Leadership

Table II: Class 'Leader' and its Attributes

Class	Attributes
Leader	Character, Charisma, Commitment, Courage, Communication, Competence, Discernment, Focus, Generosity, Passion, Initiative, SelfDiscipline, Teachability, Vision, ProblemSolving, PositiveAttitude, Relationship, Responsibility, Sex, Servanthood, Recommended Leader

Ontology is a formal representation of concepts and the relationship between those concepts in a particular domain. Here 'Leader' is the only concept that we are interested in. So we create a class called 'Leader'. Fig 1 shows the class "Leader" and its attribute in myCBR plug-in. The Class Leader has the following attributes and constraints and it is given in table II.
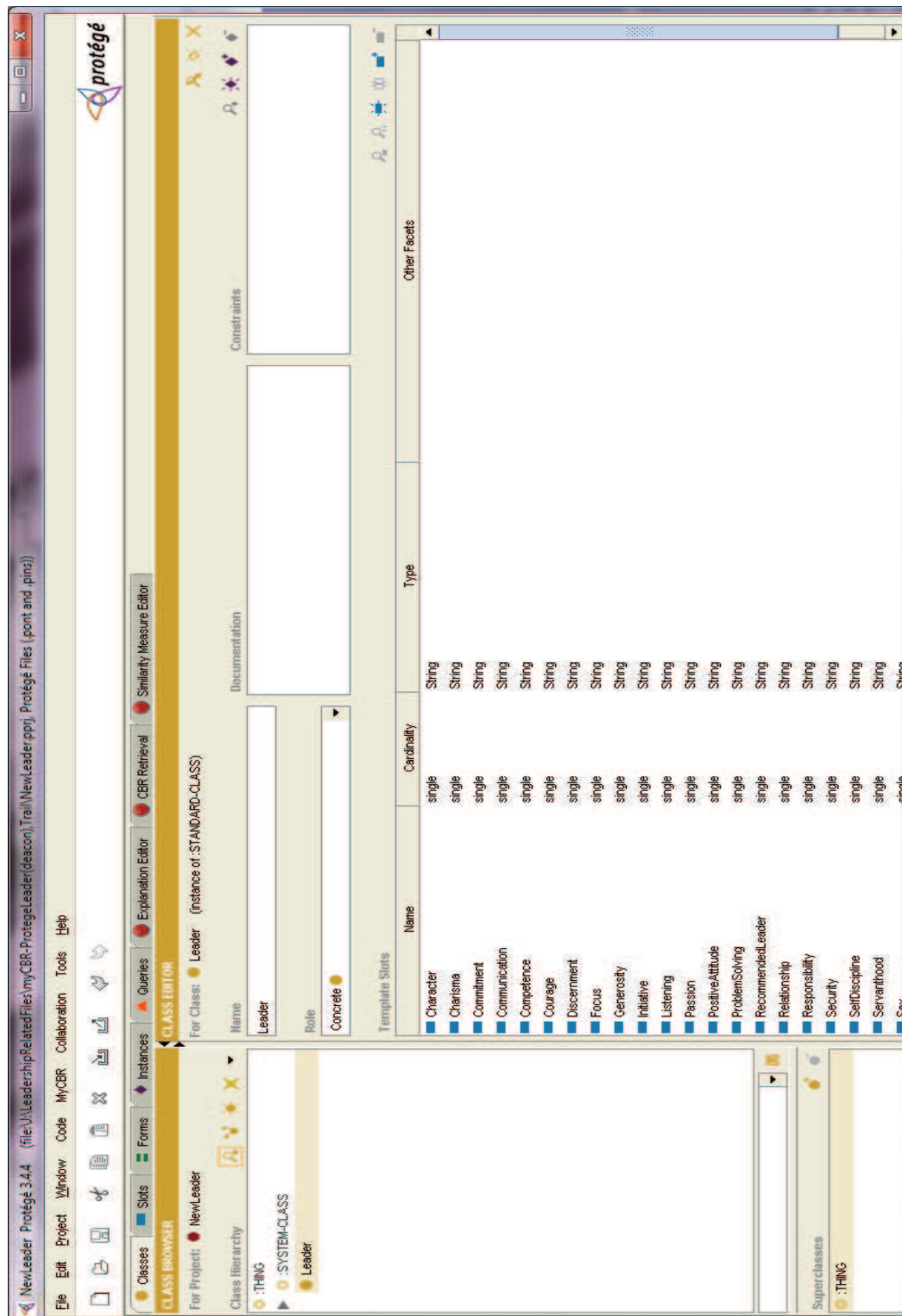
Fig 1: Leadership Type Recommender System (myCBR)-Class 'Leader' and its Attributes

1.1   **Similarity Modeling :** Similarity modeling is giving weight to each attributes of the classes in the Ontology. Based on the weight of the attributes the stored cases are retrieved from the case bases. Similarity Measure Editor is the tab used in myCBR to give weight for each attribute. There are two types of similarity measures

i)   Local similarity measure
ii)   Global similarity measure.

Local Similarity Measure: Local similarity measure is giving weight and constrains for each attribute of the class 'Leader'. Here since all the attributes are of type string, the condition 'partial match' is given to all. All the attributes are given weight 1. For attributes of type 'Integer' and 'Float' advanced similarity measure is given which means there should be an exact match in the query and the retrieved case. Fig 2 shows the settings for local similarity measure in myCBR. The local similarity for attribute 'Character' is given here. The similarity function for it is chosen as 'Partial Match' and the similarity mode is 'Standard'.
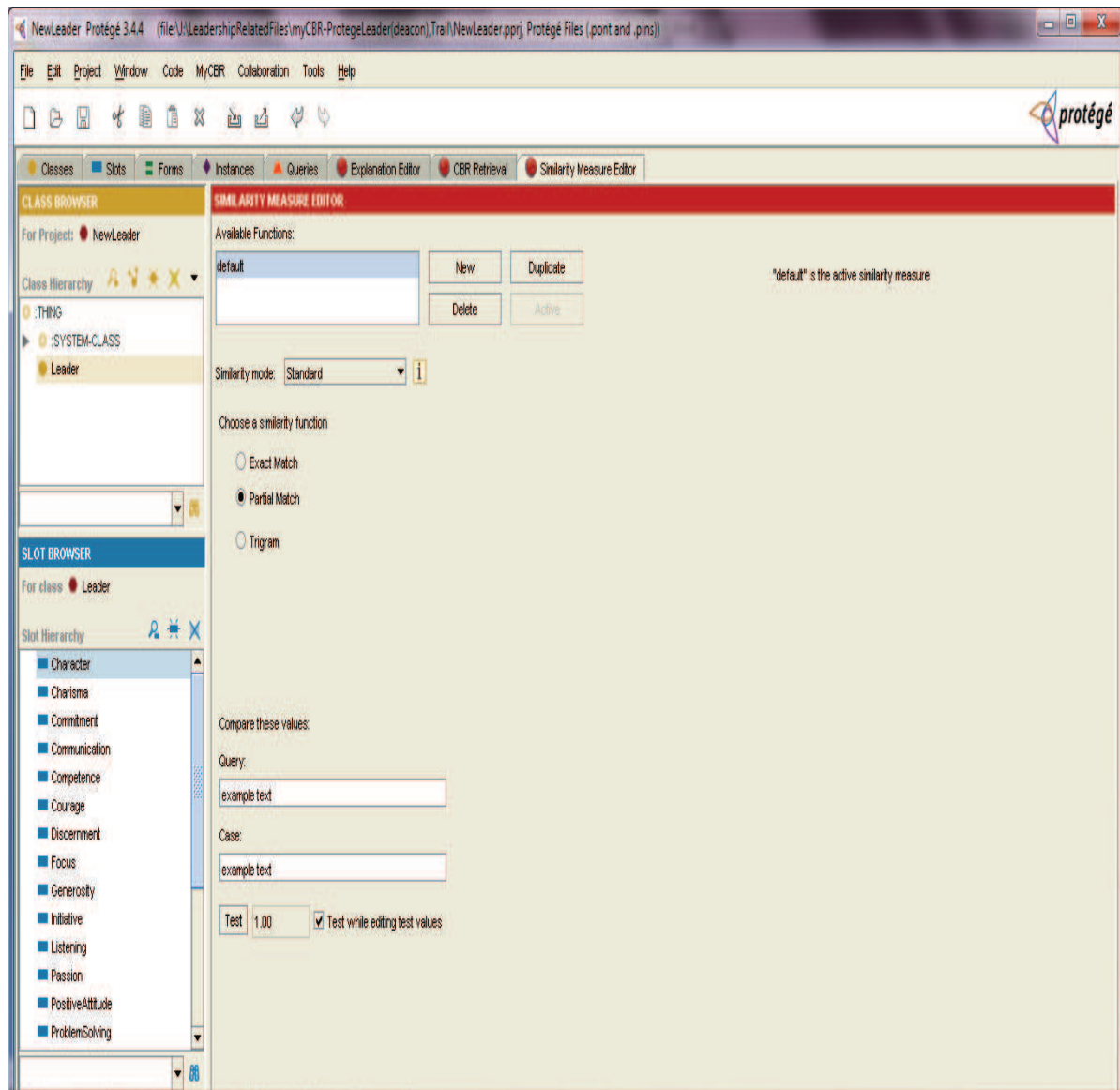

Fig 2: Local Similarity Measure Editor for Attributes

Global Similarity Measure: Global similarity measure is giving weight to the class as whole. Here the class 'Leader' is given weight and constraints. Fig 3 shows the settings for global similarity measure tab in myCBR. This includes four tabs

- Discriminant – It means that whether an attribute should be included in calculating the total weight of the class.
- Weight – Giving specific weight for each slot
- Local SMF – This is Local Similarity Measure Function and it indicates whether an attribute has Local similarity measure
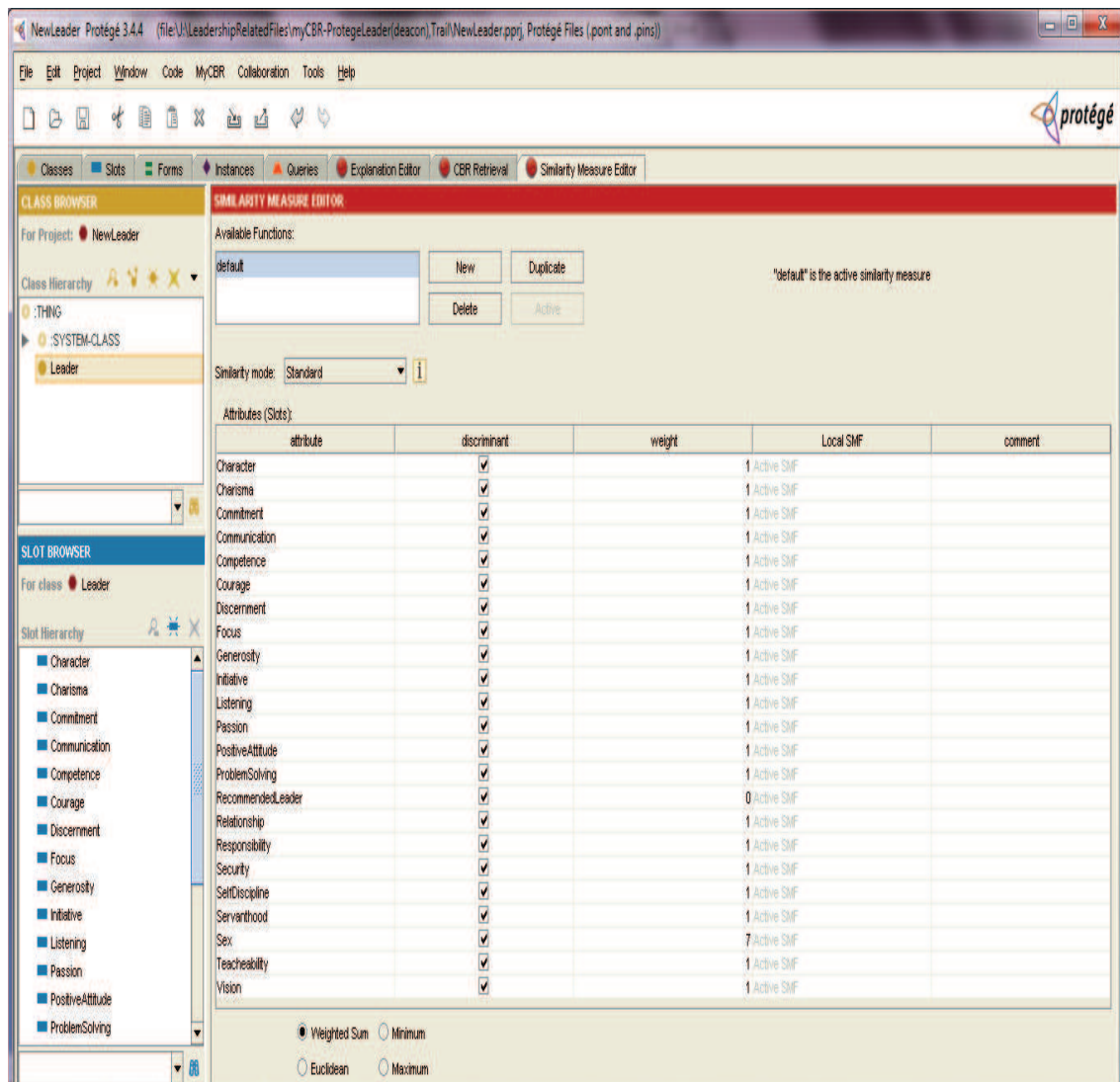- Comments – This is Optional tab. The description of the attribute is given here.

Fig A-1.9 Global Similarity Measure Editor for Classes

Retrieval Engine: After setting the similarity measures, Retrieval Engine is used to execute the query. In myCBR, CBR Retrieval tab is used. It is shown in Fig 4. The user can input query in two ways
1. The user can input his query manually
2. The user can load the query from the stored case base and can modify it

Once the query is fed in, retrieval is done and the cases are retrieved and ranked according the similarities. The first three cases are displayed and the user can view his recommended type of Leadership. After retrieving the cases, the user can store the current case in the case base for the future reference.
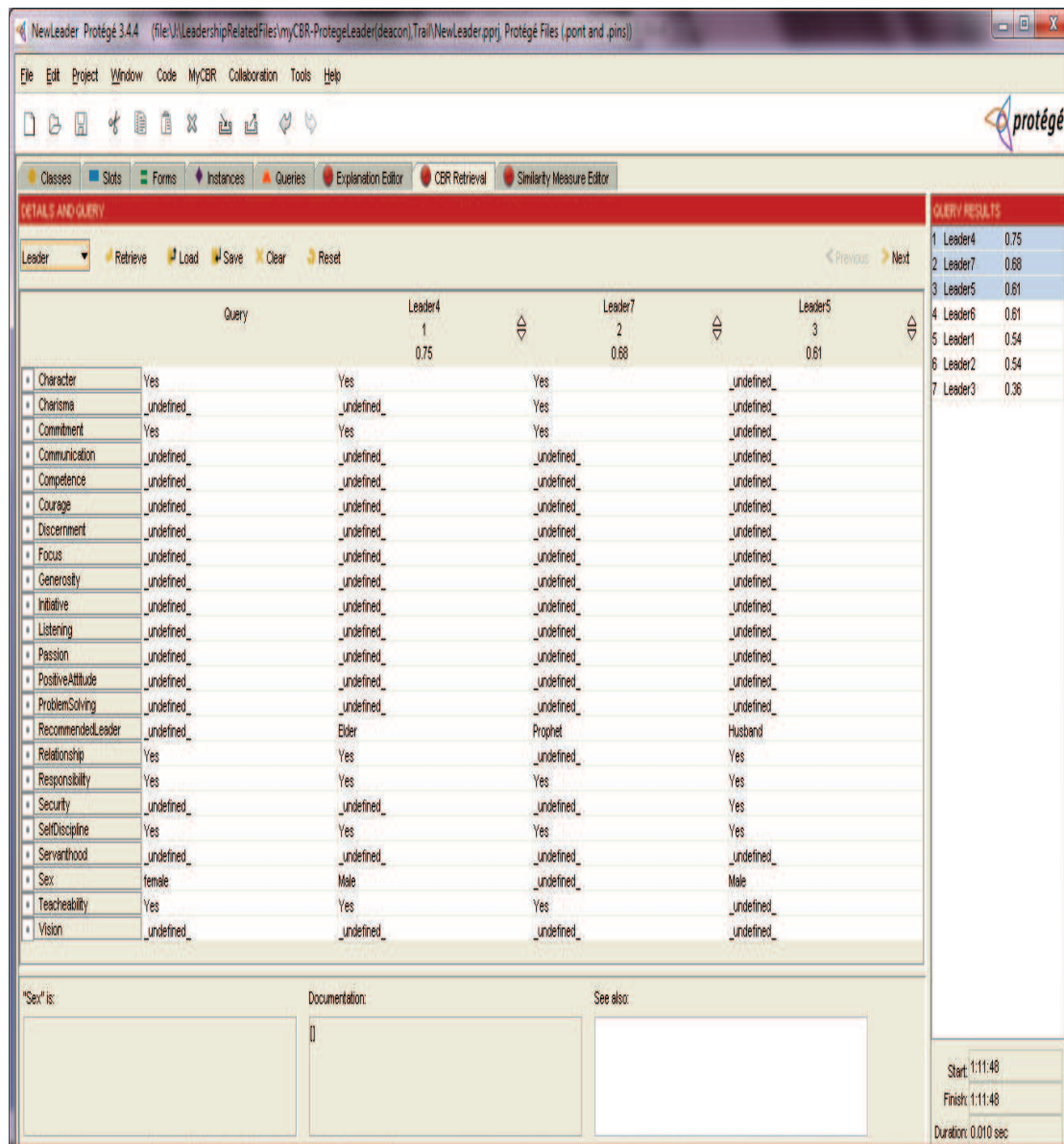
Fig A-1.10 CBR Query Retrieval Tab

Conclusion: This work covers the development of Ontology and CBR System. The advantages that Ontology provides when they are used in CBR system are that they are persistent and they act as the knowledge source to get semantic reasoning processes like retrieval, similarity and adaptation. In conclusion, the recommender system recommends leadership position suitable for the user based on Biblical perspectives. Thus any user can use the built application to assess his leadership traits, recognize his eligibility status for a leadership position and also receive Biblical recommendations to equip him for leadership.

The future work in recommender system, myCBR plug-in can also be made into a standalone application so that development of a CBR system is not done inside the Protégé editor and it can also be made into a web application by developing in jColibri version 2.1.

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