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SEMANTIC AND ONTOLOGY DESIGN IN VSIS

[1]HUAZHU SONG, [2]ABDUL-LATIF KHAMIS, [3]LUO ZHONG

[1]Assoc. Prof., School of Computer Science and Technology, Wuhan University of Technology

[2]Ph.D Candidate, School of Computer Science and Technology, Wuhan University of Technology

[3]Prof., School of Computer Science and Technology, Wuhan University of Technology

E-mail: [1]juliprn@sina.com, [2]khasmi82@gmail.com, [3]zhongluo@whut.edu.cn

ABSTRACT

we tried to increase semantic in the visual stock information system. Firstly, the semantic entity-relation model was given after studying the contents in visual stock information system and the hierarchical classification was shown. Then, semantic metadata and visual ontology was designed. For the implementation of VSIS, ontology reuse was considered which included ontology reuse model, the relationships among ontology, database and the user and some agents.

Keywords: *stock information system(SIS), semantic, ontology, visual ontology*

1. INTRODUCTION

We consider that semantic technology and visualization technology [1]-[5] share a common understanding among the system user; we argue that ontology is the new area of technology for approaching and solving problems of explicating semantic knowledge about visual information. Semantic technology is commonly used for conceptualizing and specifying the domain of interest in order to captures the user's interest while visualization provides the graphical representation for conveying the domain knowledge and increasing the visual interaction between the system and user.

The semantic goals for VSIS model are to enhance end user accessibility knowledge on the stock system for providing an effective visual interaction model. This is because Semantic and Visualization Technology can provide an abstraction layer above existing Domain that enables interconnection between the semantic data and the application domain for the specified Ontologies [6]-[8]. Semantic technologies can be taken as a new level of depth that supports more intelligent application for relevant and responsive user interaction. Ontology Construction is seen as an appropriate process for conceptualizing and fulfilling user demand in software project development where most of intelligent application relies on reducing the complexity among the metadata, eliminating the uncertainty by specifying a particular domain of interest that enables user and machine to understand, reason and share common vocabularies [9].

Implicit of the VSIS Ontology model is very important for knowledge representation [10]. For the efficiency of VSIS model, each class of nodes defined in the VSIS domain and categorized are the same as those worked in programming language. Each parent node is formed with number of child nodes from the root level. The child's nodes are linked to the parent's nodes via their relational property; each instance can have more than one property, which can make the node share similar characteristics, which make the ontology visual graph have many nodes connected to each other.

2. SEMANTIC ER MODEL FOR VSIS DESIGN

As the Technology of Semantic goes beyond the scope, the semantic technology of database design can be used as the best methods of modeling and capturing user's data and requirement. It has more utilities to provide a robust and effective database model. The Entity Relational Model is used to express VSIS Database design; ER provides clear, meaningful and understandable structure of the VSIS database model that used to build Visual Stock Information System. The ER Model for VSIS, provide a relationship among the Stock Data Tables, it links the relation between transaction data, historical data and Stock companies data which could be easier and useful for conceptualization and normalization of model

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VSIS. The Entity relational model is designed according to the VSIS requirement; and is typically gathered from the observation acquired during the Data collection for this study. Figure 1 represents an entity relational model for the VSIS and stock Domain.

The goal of using ER model in the Semantic Visualization Design is because of both ER model and Semantic model are used for documenting, analyzing and capturing the knowledge of Domain for user's requirement and convey those into VSIS database.

According to the VSIS design model, the VSIS Database Model is based on the seven types of Stock Entities similar to the way classes of Stock represented on the ontology pools of Domain, these are Stock Info, Transaction Data, Company Profile, Financial Statistics, Financial Value Measure, Competitors and Holder Info, each of these entities has got several attributes based on the stock information. The database ER – Diagram shown in Figure.1 is clearly describe the relation among the VSIS table, such as Stock Info table used to record the Stock Quotes, actual name derived from the Stock company and stock description. Company Profile is the table that holds stock company profile such address of the Stock company, Stock Quotes is used as a primary key in the Stock Info, therefore it can contact with the Company Profile table using foreign key Stock Quotes in Stock Info Table. The ER diagram also provides cohesive types of relations in which tables are relating to each other using a primary key, a column whose entity value can be used to relate another VSIS table of uniquely identified rows. Moreover, it can reduce the redundancy of data and eliminate the noise of data in the VSIS database.

The approach of VSIS model is based on the postulation that the structure of the information already holds part of semantics meaning in terms of the domain knowledge of the VSIS database design, therefore, the derivation of semantics from

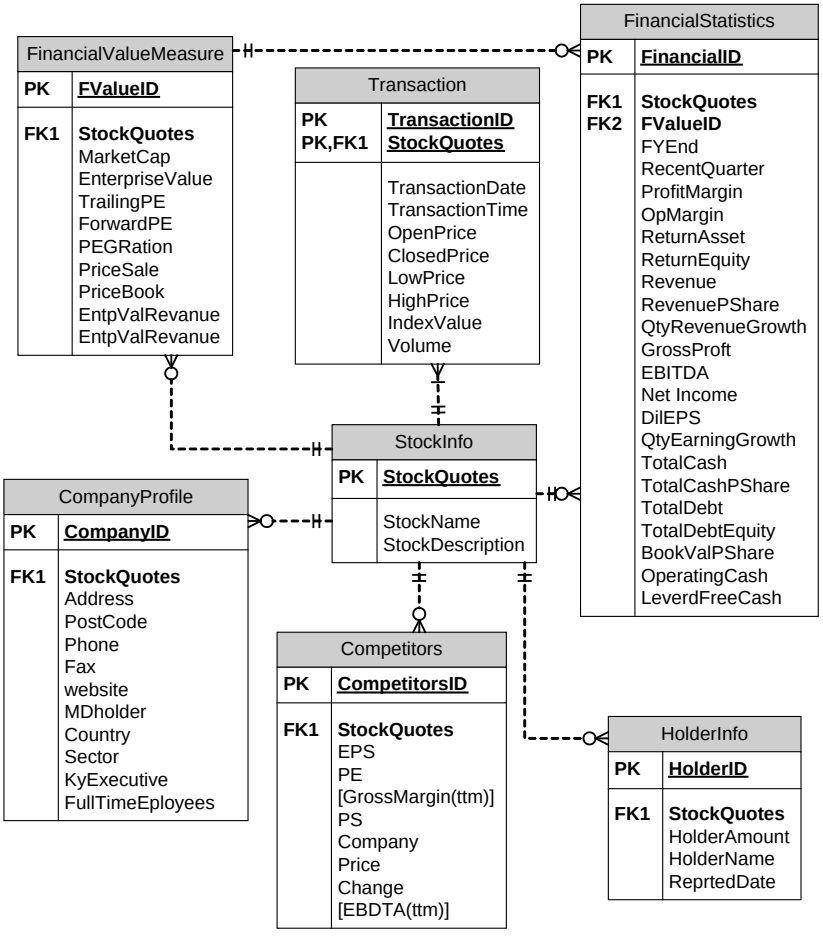

Figure.1 VSIS ER-Model

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information structures can be used where the structured information has to be griped, according to the Semantic Model of VSIS design and each Database table corresponding to the one ontology class and each attribute to one node in the VSIS domain.

The VSIS database system provided many capabilities and handles important tasks that are crucial to application accessing the stored data. It made up two parts of data according to VSIS design model transaction and non-transaction data. The transaction table holds all necessary information about the Stock transaction data. Most of the entities on transaction table have a direct connection with stock company. It involves the information about buying and selling of stock and also profit and lost during the transaction period. The non transaction data is data that contributes to the company value (i.e. existence of financial status of the stock company and their competitors).

3. HIERARCHICAL CLASSIFICATION IN VSIS

Taxonomy is a hierarchical tree structure of classification of entities within a VSIS domain based on the common ontological characteristics. It models hierarchical relationships between terms in the VSIS domain, with the most general at the top and the most specific at the bottom. Classes at high up of VSIS domain hierarchy represent the functionality of the system in common and those at further down of hierarchy represent specific functionality of the VSIS. The structure of semantic classes in hierarchical diagram, provide an in-detail organization of the stock Information System. The system consists of a set of classes, relations, attributes and instance of the classes. Figure.2 demonstrated the hierarchical classification of the Stock Information System and their relationship.

The VSIS Domain is built up of six main classes as we introduce earlier; Visualization Function, Enquire Function, Database Operation, Error Processing, User Interface and Stock Domain. Each class has its own subclasses with corresponding relationship. The VSIS is simply based on number of subclasses, attributes and instances of the class. The Entities of Class were categorized by the square block; Attributes of Class are symbolized by oval shape. The Attributes and Entities of Class are described and classified by three types of lines of relation.

4. SEMANTIC METADATA IN VSIS

Considering the technology trend in stock market, there are abundance of stock reports and analyst, there are a vast varieties of stock graphs and charts for the current and historical stock data in the stock market and increasing the number of online news e-news but what is missing is the organization of this stock information and stock data. Majority of stock organizations have yet to see the valuable of metadata for organizing their information in the stock market. Some organizations have decided to use semantic technology to organize and create an information model (ontology). In better modules for the future scope, which are based on metadata schema taken from a particular stock organization or stock industry but the focus is that; the integration of information depend upon the way semantic data as organized in the respective domain. Individual application database schema is mapped to a standard information model in order to make the meaning of the concepts in different, application-specific metadata schema explicit and relate them to each other. The resulting information architecture provides a unified view of the data sources in the stock organization, where by a user can establish a query from those semantic metadata, which comprise the RDF data ontology or Ontologies. Standard Ontologies reconcile queries needing access to heterogeneous data sources and application-specific schema. Semantic metadata is unique and valuable in that it can establish the relationship between the open and closed stock and can even play a major role on the next day prediction of the stock price.

Semantic metadata is an important aspect that realizes the value of semantic information by annotating or enhancing document with semantic metadata. The VSIS use semantic metadata scenario to boost the value of application developed so that the VSIS can understand the framework and meaning of information to be visualized by user. Metadata can uncover the knowledge from dataset by organizing the stock data for the user beneficiaries. It creates the understandable environment so that user can understand the stock data and what the data implies. This way that the user can analyze and be linked to the extracted information from the VSIS Ontology base understanding the unknown relationship between

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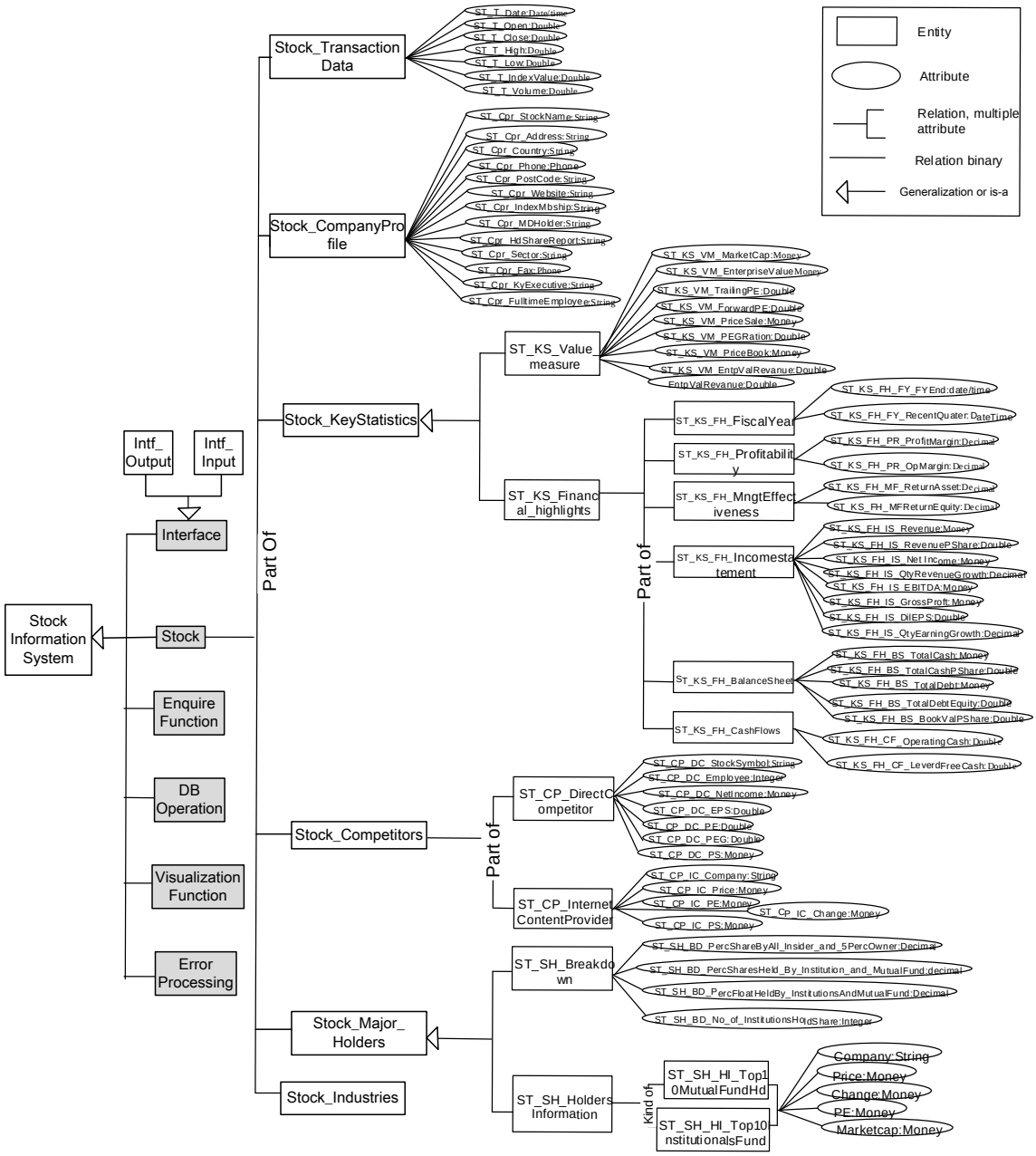

Figure.2 Hierarchical Classification In VSIS

the stock data on semantic could be used for better decision. Semantic metadata can also be used to increase the automation of extracted information process, normalization of stock data and maintenance of knowledge by producing fast and high quality querying and visualizing analysis for relevant stock information. Ontology and metadata can be seen as interrelated components that provide a shared interest by specifying tools for automation, automatic classification and organization for Domain Taxonomy. Figure.3 illustrates the emergence of semantic metadata in the VSIS domain taxonomy for information visualization.

From stock data integration to application integration, the value of metadata has been long recognized, however, only with the progression from syntax and structure to semantics can both user and VSIS start to associate meaning with stock information and statistically using stock metadata. It becomes simpler for ordinary user to identify the periods of day when the highest as well as the lowest number of shares for a selected company have been traded.

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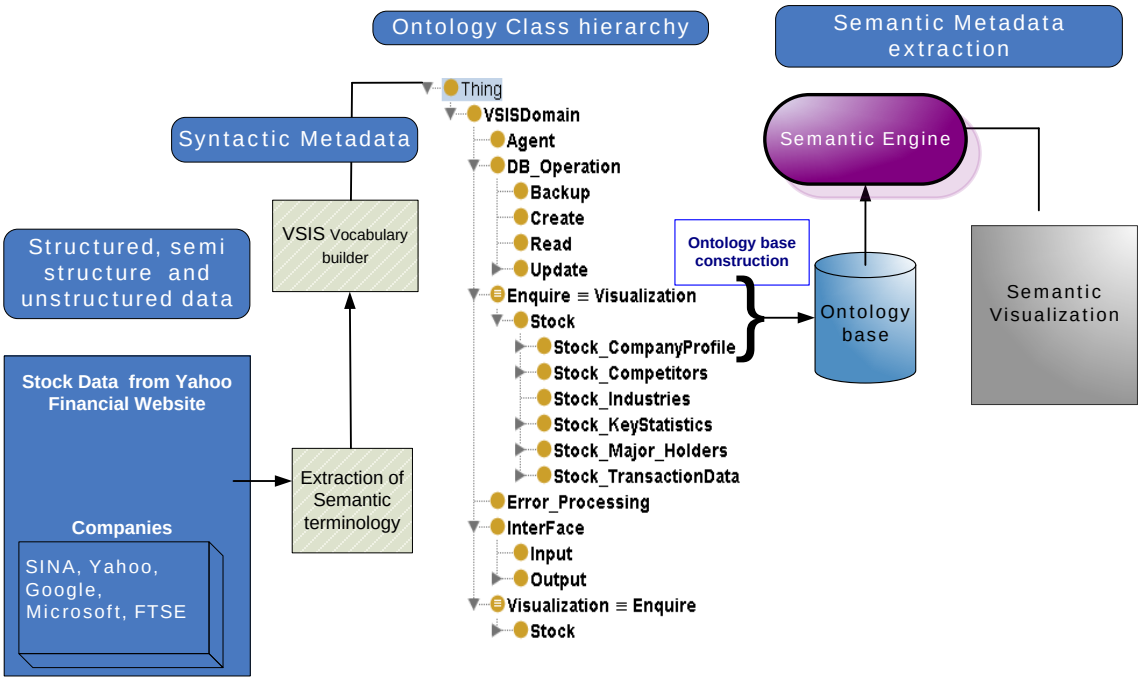

Figure.3 Semantic Metadata Structure For Information Retrieval In VSIS

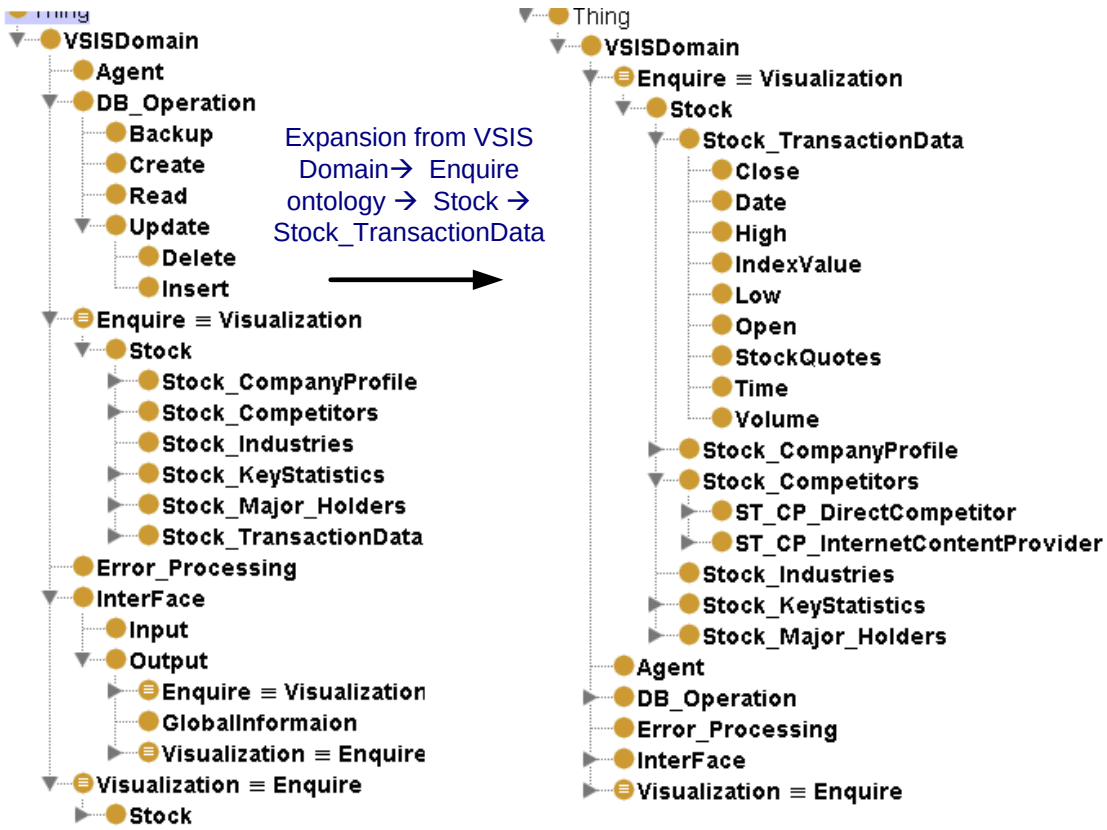

Figure. 4 VSIS Ontology

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5. VISIUAL ONTOLOGY IN VSIS

The ontology graph from RDF contains information, not just a relational properties among the nodes but also causal structure of metadata for data model. Figure 4 below produced by protégé ontology editor using ontology shows the VSIS domain and their classes grouped together with their relational properties, it also shows information for each class in the VSIS domain. The properties for VSIS Ontologies are shown with colored line, where by each color symbolized one property of an instance, but due to the complexity of VSIS ontology structure, it is not possible to see overall structure of the grouped classes. More over Ontology can be rated as top methods of organizing the complex data structure.

This study views ontology as a graph of specified information, with terms (concepts) as nodes of the graph and relationships as the links that connect the terms. Many relationships in VSIS ontology model are directed, meaning that they are only true in one direction (e.g., Major Holder is part of Stock Domain but a Stock is not part of a Major Holder); because of this, Ontologies are often represented in taxonomy of class hierarchical structure. The relationships used in ontology are not predetermined, so any real-world relationship can be logically defined, used to connect terms and reflect reality. This makes Ontologies a flexible framework for modeling many different kinds of data. In addition, the Protégé can also be used to show class with the relation, such as the default relation which shows the nodes from top level back to the root level or original class. The complex structure of VSIS domain is not as important as the methods of organizing the stock data into well organized and measured input concerns. The root of VSIS stock domain to the end node of the class schema can be further subdivided in to more classification nodes and classified as a VSIS tree structure of taxonomy instances and values, shown in Figure.5.

There are much difference when considering knowledge base and database; this is due to the fact that knowledge base contains more information about data they hold. While data base can be used to hold information about the types of data they hold such as string, integer etc. In knowledge base, we can have axioms that are used to support reasoning about particular data and taxonomy structures that define the VSIS domain and the classification of VSIS instances. The VSIS uses relationships to define instances as relation. All of these can be defined in the ontology that is used as a backbone for knowledge base implementation. These advantages do not come without shortcoming. Data storing, or implementation of the knowledge base, is much simpler when using database.

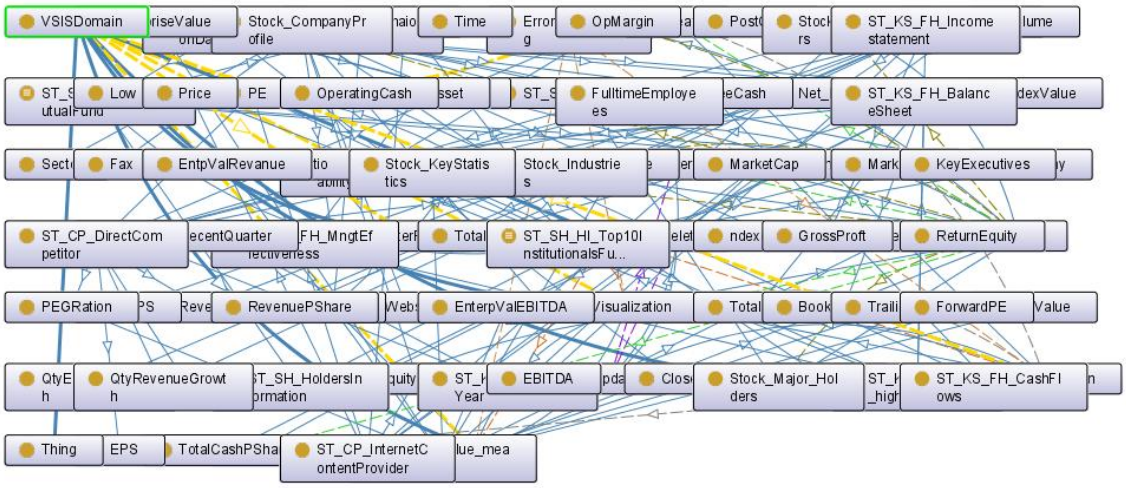

Figure.5 Semantic Metadata And Their Relation In VSIS Ontology

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6. VSIS ONTOLOGY REUSE DESIGN

The use of an ontology reuse model is an important step in the VSIS domain data for understanding requirements design of the successive data models. Ontology reuse model is considered because of its unyielding spirit on the user perspective. The key objective of this section is to develop the structure that helps user to understand the VSIS system model to enrich the semantic goals. The overall functionality of VSIS Ontology reuse model can be divided in to three main processes; Query Transformation, Enquire Mapping and Visualization Transformation. Figure.6 provided an overview of VSIS Ontology reuse model.

The Query Transformation consists of Domain database, application server Database operation that uses the ODBC technique to connect between server database and application program. The ODBC is used as standard mechanism, which provides an interface connection between VSIS application (Enquire mapping) and VSIS Database in the Application Server, the VSIS domain Data contain information about stock historical data that will be queried away during the Visualization process. The use of ODBC in the VSIS Model is aimed to make it independent for either database systems or user operating systems. This is accomplished by using an ODBC driver as a translation layer between the VSIS model. Enquire Mapping Application layer and the Data Transformation layer through VSIS database, therefore, the ODBC driver can then pass the query to the VISIS database in its native format, returning the data in a format the applicant can understand.

Enquire mapping provide the functional module to support DB query, agent visualization and agent enquire in the VSIS model. The Enquire mappings transform the user enquire to the VSIS Domain Database, it supports users query and provide maximum capabilities to handle user interaction in the VSIS application. Enquire mapping coordinates between the two main part of the VSIS model, it acts as an intermediate connector between Visual Transformation and Query Transformation. All user acquirements should be decided here, translated and then transferred to the VSIS Query. transformation. On the other hand the information that is requested from the Domain data has to be translated and transformed to meet user requirement, so that they can provide a better visual mode. Some user enquire are not based on the Domain data in the server, the optional data can be visualized without intention of database system.

The Visualization Transformation includes User and Visualization Module. Visualization Module provides all necessary facilities to the user so that he can visualize the stock information from the VSIS user interface. Visualization Transformation provides visual information about particular stock information, increasing the user capabilities for modular inline and for stock data analysis and to create effective and efficiency interaction between the user and VSIS.

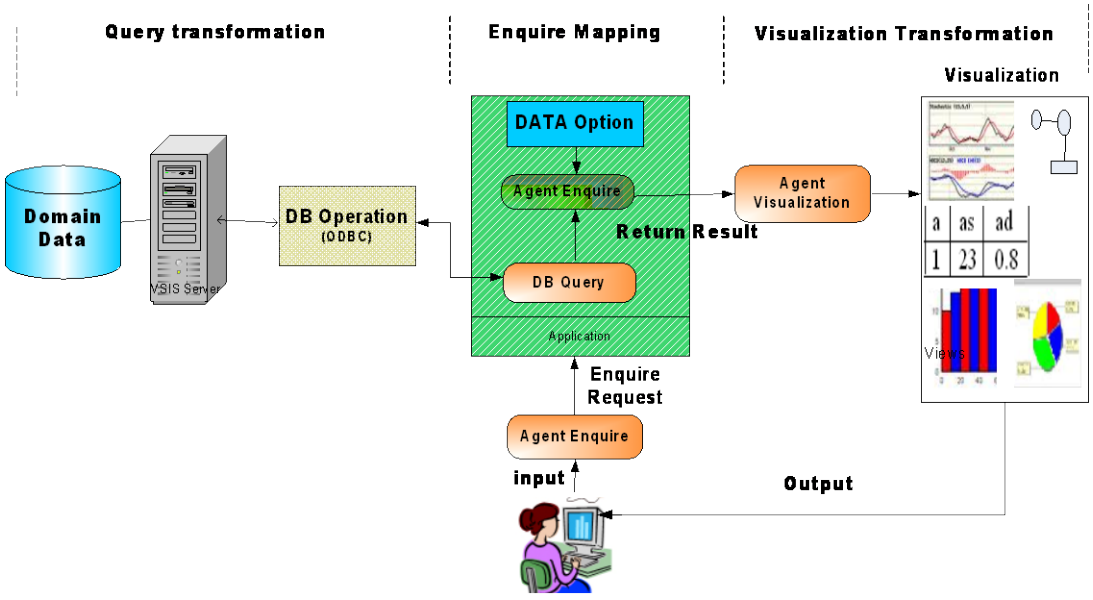

Figure.6 VSIS Ontology Reuse Model View

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On the other side, VSIS Ontology reuse model consists of set of intelligent agent that capable of autonomous action on the VSIS environment. In order to meet the VSIS objectives, agent Visualization, Agent Enquire and DB Query all work together for the purpose of decreasing maximum complexity and minimizing the dependency in the control logic of the VSIS model. This means that the system should be able to act on/or without direct human intervention and should have its own internal state control over its own action. Each Intelligent agent in the VSIS model has to collect information about the status of the neighborhood's agent, so that it can be perceived correctly in the right time.

(1) Agent visualization play major role in VSIS model. It deals with all user inquires that need to visualize stock information. Although agent visualization has to consider some challenges that will occur during the visualization process, this is because the volume of data to be visualized are huge and most are dynamic rather than static, therefore, the VSIS model is design to handles all necessary visual means that represent the multitude of data types.

(2) DB Query is the way that the VSIS dynamically and visually control the amount of stock data to be visualized in the system. The user has the right to execute the query on the VSIS dataset and visualize the result of query through graphical user interface. DB Query perceived with the association of enquire agent, visualization agent and with each data attributes in the domain whose manipulation changes as the user enquire those request. To reduce the gap between user query and the system interpretation of queries, visualization concepts are used as ontological similarity technique. Queries can extract more semantically complete results from relational data by associating relational data with VSIS Ontologies that organize the domain knowledge of the relational data.

(3) Agent Enquire facilitate the user's demand during the Visualization transformation. Enquire agent is an important agent for the VSIS model; it plays in the intermediate level of abstraction of Data Transformation and Visualization

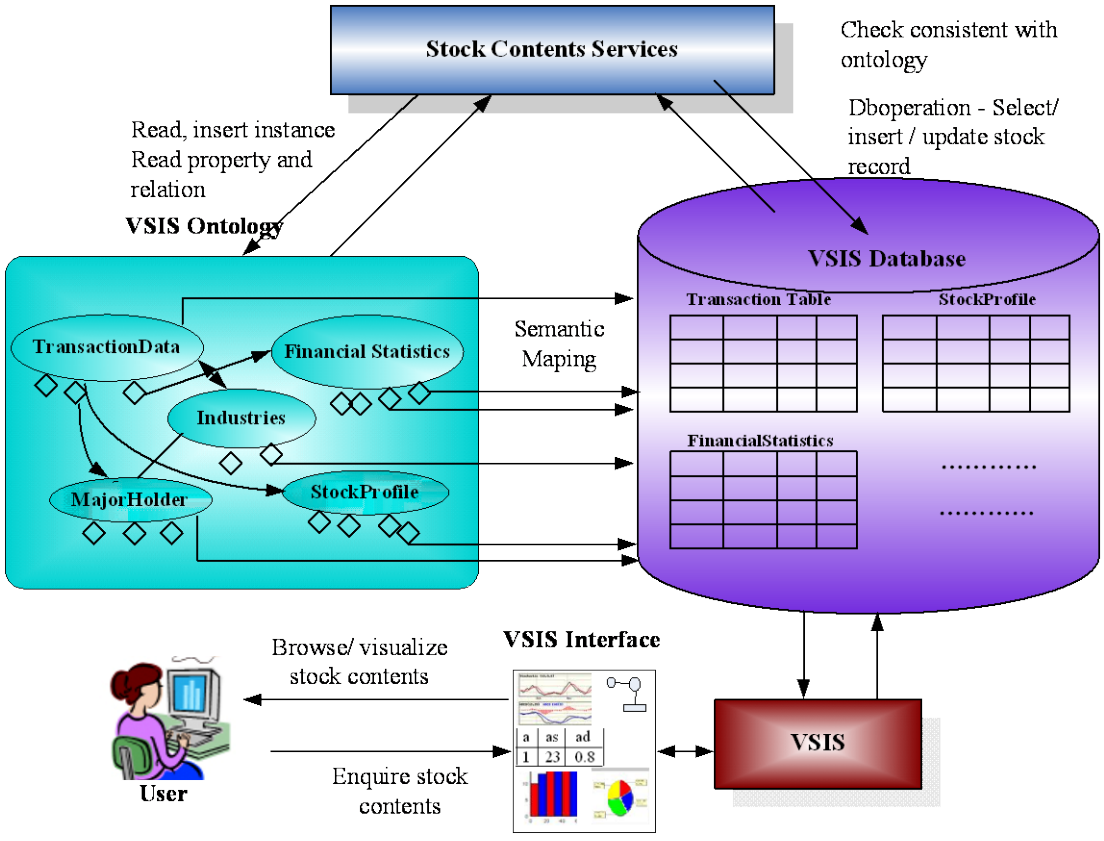

Figure.7 Relationships Among Ontology, Database And VSIS User

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Transformation. Agent enquire receives enquired information from the users and send the perceived enquire request to the Agent Query. The Agent also receives the perceived result from Agent Query and sends to the Agent Visualization for the user to read the results.

It is important to note that, the user only need be concerned with the technical aspects of the application, such as what information is suppose to be enquired to the system, also the user should understand the system and what to be visualized from the VSIS. Meanwhile, the mechanics of the VSIS interface should not be an additional concern; all user access is through the local machine to the VSIS server, only a PC browser is required for VSIS communication in Figure.7. The VSIS user can initiate the communication and send the request through graphical user interface (GUI) by input information and to the enquire agent.

7. CONCLUSION

In VSIS, we combined the technology of semantic and ontology with the technology of visualization in the prototype. There are many different kinds of stock information, VSIS ontology was attained to demonstrate the semantic and logic information by discovering the relations in VSIS. The designed ontology was to represent all information in VSIS pool. In addition, the ontology reuse in VSIS was discussed for developing VSIS model.

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REFERENCES:

[1] W. C, “Information Visualization: Perception for Design”, Morgan Kaufmann, (2004).

[2] R. D. Edwards, J. Magee, and W.H.C. Bassetti, “Technical Analysis of Stock Trends 8th ed”, AMACOM Publisher, (2001).

[3] H. Levkowitz, “Color Theory and Modeling for Computer Graphics, Visualization, and Multimedia Applications”, Kluwer Academic Publishers Boston Dordrecht London, (1997).

[4] D. Cox. “The art of visualization. Aesthetic Computing”, MIT Press, (2006).

[5] F. Bendix, R. Kosara, and H. Hauser, “Parallel Sets: Visual Analysis of Categorical Data,[C] Proc. IEEE Conf. Information Visualization, 2005, pp. 133-140.

[6] MICHAEL RAJ T.F, “An Integrated Approach to Rapid Automated Service Discovery of Semantic Web Service”, Journal of Theoretical and Applied Information Technology, Vol. 40, No.1, 2012, pp.78-82.

[7] K. LIU, S. TANG, W. PAN, “Semantics Based on Distributed Interpretation for Ontology Integration”, Journal of Theoretical and Applied Information Technology, Vol. 45, No. 2, 2012, pp. 681 - 687.

[8] D.A. Keim, F. Mansmann, J. Schneidewind and Ziegler, H, “Challenges in Visual Data Analysis”, Proceedings of Information Visualization 2006, IEEE press, IV 2006, 2006, pp.9-16

[9] Ontology (computer science) [EB/OL] http://www.singaporemoms.com/parenting/Ontology_(computer science) (accessed December 10, 2010).

[10] H. Song, A. Khamis, X. Song, “Ontology Design in Visual Stock Information System”, Advanced Materials Research, Vol. 225-226, 2011, pp.771 -775.