Abstract

This work is devoted to the study of Fuzzy Object-Oriented Database Systems (FOODBS) which is capable of handling precise as well as imprecise data. FOODBS incorporates all the fundamental aspects of Object-Oriented Database Systems (OODBS) such as aggregation, specialization, inheritance, messages and methods etc. In addition to this, it incorporates fuzziness at attribute level, object-class level and class-superclass level. Accordingly fuzzy attributes, fuzzy objects and fuzzy classes have been introduced in FOODBS.

In this study, we have discussed three important aspects of FOODBS, which are critical to the success of database environment. These are study of (1) Methodology for describing a conceptual model (2) Algebra for processing complex objects and (3) A new access technique.

Real world database application requires users to specify their need to represent, store, manipulate & query imprecise as well as uncertain information in a natural language like English. In recent past, various researchers have developed different fuzzy object-oriented database systems. In our study, we have developed a methodology for describing a conceptual model of a fuzzy object-oriented database system. The model proposed consists of three phases. In the first phase, a fuzzy natural language requirement specification language (FRSL) is designed to represent user requirements. Next, the FRSL requirement specifications are translated into a Fuzzy Object-Oriented conceptual model composed of Fuzzy Nested Entity Relationship Diagrams (FNER) and Fuzzy Updated Protocol Model Expressions (FUPM). Finally, a Fuzzy Object-Oriented Data Model with the help of Fuzzy Meta-Knowledge Base (FMB) implements the FNER diagrams and FUPM expressions. The steps of the proposed model have been illustrated with one example "Environment Pollution Information System (EPIS)".

We have made an attempt to develop the algebra for processing complex objects in a fuzzy object-oriented database system. Unlike most of the existing query languages, the design of this algebra is based on the type and set aspects of the class. We have presented a framework for executing set theoretic operations namely union, intersection, and difference on the class construct. The set operation on the membership of the corresponding class containing fuzzy objects have been developed by using object identity and the membership-value (MV) of the object. The type description of the resulted class derived by a set operation is specified. We have also discussed the inheritance property characteristic for the derived class for fuzzy objects.

A separate access structure for a fuzzy object-oriented database system has been proposed. The new access method called "Fuzzy Path Dictionary Index (FPDI)" supports a large variety of queries, object traversal, associative search and efficient query evaluation. FPDI consists of Fuzzy Path Dictionary (FPD), identity index, Fuzzy Metaknowledge Base (FMB) and a set of crisp as well as fuzzy attribute indexes. We have discussed various aspects such as storage, query and update operations for different components of FPDI and also developed the respective cost models. We have also compared this new mechanism with another method called Fuzzy Path Index (FPI) for fuzzy object-oriented database system. We have shown implementation of FPDI as a secondary file organization using S-expression scheme without modifying the database. We have also discussed how FPDI method, in overall, is better than FPI (Fuzzy Path Index) method for FOODBS in various aspects. The FPDI access method is explained taking "Environmental Information System" as an application.