Data Analysis and Designing Fuzzy Object-Oriented Database

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Abstract. Several kinds of database are available here that are used for storing and retrieving traditional relational information rather than the imprecise and uncertain information. This imprecise and inconsistent data or information frequently occurs when we extent documents where the best we can do is to approximately date them. For example, the date of any ancient monument from certain date to certain date i.e. a range of date, which is not clear. Therefore, it is very much clear that some uncertainty exists when we considered the exact date. To address the uncertainty and impreciseness in data, a new type of database is evolved named fuzzy database. A fuzzy database is named fuzzy due to its theoretical formalization is based on fuzzy logic, in that there is a gradation of values between 0 to 1. Therefore, to reducing the fuzziness in the fuzzy database a fuzzy object-oriented database is designed here for the domain of Health-Care due to there are so much impreciseness and uncertainties in data of medical health-care domain. Therefore, in this paper a fuzzy object-oriented database is designed here and perform some fuzzy queries to validate the performance of it. We focused on the continuously propelled augmentations of Fuzzy sets and their blends in with various contraptions could offer a novel promising planning condition.

Key words: object-oriented database, fuzzy logic, UML class model, fuzzy object-oriented database.

Introduction

The Object-Oriented Database was intended to address the issue of more mind-boggling applications that has immense and complex data set. It is the blend of information base and article situated programming. The article situated data set gives adaptability to taking care of the perplexing necessities without being restricted the information types. The critical piece of the item situated data set is it takes and stores the fresh data or information. It offers to get to the information in a quicker way concerning the customary data sets. The article arranged information base is extremely proficient and compelling in such regions where the tremendous or enormous measure of information around one information is required. In reality applications the data is unsure and dubious. For dealing with that types of data the idea of fuzziness is present in the customary social information base. In any case, the social data set has store the repetitive and equivocal information. In this way, programming experts and specialists have engaged and moved towards the Object-Oriented database to deal with the unpredictable articles and Fuzzy data together. Thusly, a Fuzzy Object-Oriented database is demonstrated to deal with that types of objects and Fuzzy data. In this work, we focused on the uncertainty and vagueness in result of queries of Object-Oriented Database. A fuzzy object-oriented database is designed here and implemented some fuzzy queries to compute the performance of the designed fuzzy object-oriented database.

Literature Review

As there is limited research is done on fuzzy object-oriented database; let us first describe the important work done previously related to the fuzzy object-oriented database. Zadeh (1965: 338-353) has presented the hypothesis of fuzzy sets and fuzzy rationale, two ideas that established the framework of probability hypothesis in 1977. As per him "the hypothesis of fuzzy sets is a stage toward a rapprochement between the accuracy of old style arithmetic and the inescapable imprecision of this present reality, a rapprochement brought into the world of the relentless human journey for a superior comprehension of mental cycles and discernment. Galindo et al. (2005: 20) have introduced a theoretical fuzzy model, alleged Fuzzy EER, and a case apparatus (Fuzzy CASE), to help the data set specialists to construct the calculated model for fuzzy data sets which are addressed in the book Fuzzy Databases: Modelling, Design and Implementation and this book has a genuine impact in the direction of the data sets courses Distinguishing source code text. On the off chance that Times Roman isn't accessible, attempt the text style named Computer Modern Roman. On a Macintosh, utilize the text style named Times. Right edges ought to be supported, not worn out. Ma and Shen (2006: 597-612) brought various degrees of fuzziness into the class of UML and introduced the relating graphical portrayals, with the outcome that UML class charts may show fuzzy data. Cross et al. (1998: 299-305) have introduced the underlying exploration endeavours to utilize ODMG-93 item information model norm as the reason for characterizing a fuzzy article information model since it is turning into a defacto standard and a few Object oriented database merchants are right now delivering business items in consistence with this norm. Yazici A. and Cinar (1998: 299-305) have presented a theoretical information model by stretching out ExIFO to deal with both perplexing and unsure for the most part, fuzzy articles and classes. Kuroki et al. (2020) have at first looked to display clinic based malignancy enlistment measures utilizing the Unified Modelling Language (UML), to explain capacities. Strategies: The object of this examination was the malignant growth library of Osaka University Hospital. Saxena et al. (2011: 440-444) have proposed a Unified Modelling Language (UML) model for the Patient Registration System (PRS). The three dimensional Data Cubes are likewise intended for quicker looking and arranging of Patient Registration data set. Mama and Yan () have evaluated fuzzy theoretical information models proposed in the writing, where fuzzy ER/EER, IFO and UML information models are predominantly examined, and surveys the utilizations of fuzzy calculated information models. Shukla et al. (2011: 1-11) have reviewed various methodologies with respect to incorporation of fuzzy strategies in object arranged information bases has been portrayed, under various classes of calculated information demonstrating, questioning, ordering and so on Saxena and Kumar (2011: 440) have addressed an article arranged data set through the well displaying language for example Brought together Modelling Language (UML). Ephzibah and Sundarapandian (2012: 17-23) have proposed a framework that discovers an answer for analyse the infection utilizing a portion of the transformative figuring procedures like hereditary calculation; fuzzy guideline based learning and neural organizations. Saxena and Kumar (2011: 442) have depicted a way to deal with send the data as an item situated data set close by held gadgets. Chen (2013: 9-11) has joined the fuzzy SQL with object-oriented database and sets up the design of fuzzy object-oriented SQL for fuzzy query. Singh et al. (2014: 174-178) have introduced an applied model has been proposed for fuzzy object-oriented databases utilizing bound together displaying language. Sudhakar and Manimekalai (2015: 84-89) have depicted the data set of the coronary illness where

there is error happens, exact data is accommodated the clients to help them a clinical fuzzy data set.

Akinyokun et al. (2015: 12-21) have proposed a Fuzzy Logic-based Expert System for the finding of cardiovascular breakdown infection. Gamal et al. (2015: 12-21) have introduced a review of various methodologies and procedures that guide fuzzy XML diagrams to fluffy social data sets or fuzzy object oriented database. Israni and Israni (2017) have Proposed the OOD model which handles fuzziness in information and to improve execution of the proposed model, an ordering strategy utilizing R tree is presented. Inquiry Processing in proposed model is contrasted and the Normal Query Processing regarding time. Zhang et al. (2020: 51219).) have presents a technique for taking care of a significant advance of information incorporations and relocations. Specifically, a proper methodology for reengineering Fuzzy object oriented database in HBase is right off the bat created. Wedashwara et al. (2015) have proposed a data set grouping calculation utilizing hereditary organization programming (GNP) with the upsides of fuzzy object oriented database displaying. Bai et al. (2018: 12686) have contemplated the strategy of demonstrating fuzzy spatiotemporal information and changing fluffy spatiotemporal information from object-oriented database to XML also. Jandoubi et al. (2015) have introduced the main outcomes concerning the planning and execution of the Fuzzy Semantic Model (FSM) as a Fuzzy Object-Relational data set Model (FuzzORM). Thang and Nhut (2015) have considered the qualities of fuzzy traits, object/class, class/superclass basing on surmised semantic way to deal with hedge algebras (HA). On this premise, we introduced strategies for deciding the enrolment degree on the fuzzy attributes this. Medina et al. (2018) represented the execution of the most productive ordering methods based on a Fuzzy Object Relational Database Management System, as per the current writing, utilizing the fundamental Object Relational Database Management System augmentation components, and study and analyse their specialized practicality and execution on a genuine System.

Results
UML Class Diagram for Health-Care System

The static conduct of the patient demonstrative and testing framework is addressed here through the class chart. There are a few credits and properties like accumulation, affiliation and speculation are addressed through the sub classes in the designed UML class diagram. A Complete cycle of analytic and testing framework for COVID-19 patient is clarified exhaustively through UML class chart. There are a few significant classes like Patient, Govt._LAB, Central_Govt._LAB and COVID-19_Center1 to COVID-19_CenterN represented in the Fig. 1. The class Patient has multiple associations with the Govt._LAB and multiple associations with COVID-19_Center while the Govt._LAB has Multiple Associations with COVID-19_Centers and single Associations with Central_Govt._LAB.

Therefore, the UML class diagram depicts the complete process of diagnostic and testing system for COVID-19 patient in which the patient has arrived at the registration section where the concerned person registered themselves by filling their details in the registration form and diagnose and test the patient by taking the swab sample for perform an antigen test and RT-PCR test. The antigen test is perform at the same time through the antigen-kit while the main test i.e. RT-PCR test is performed at the government laboratories through the swab sample. The test report took 24 to 48 hours to give the result, if the RT-PCR is positive the health worker called the person and asked the status of the person. If the person having breathing problem then the health worker came and take the person to the COVID-19 Centre and start treatment while if the person don't have

so much breathing problem then they will suggested some medicines and home isolation. The patients who are admitted in COVID-19 centre are detailed diagnosed by the concerned doctor and the patient is admitted in to the ward and the patient go home after the doctor declared fit.
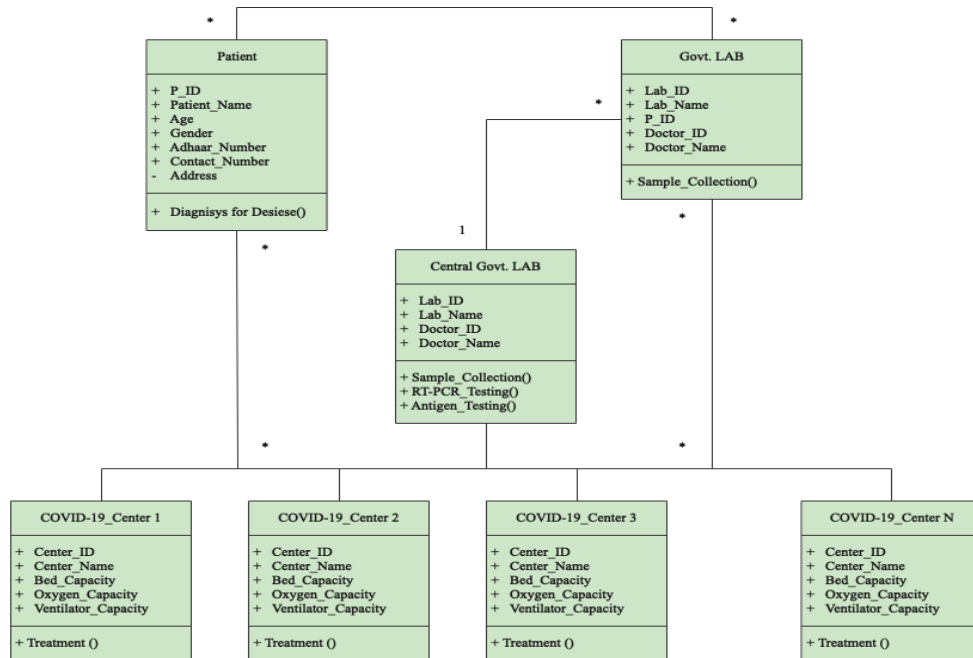

Fig. 1. UML Class Diagram for COVID-19 Patient Diagnostic System

UML Sequence Diagram for Health-Care System

As we have described the patient diagnostic and testing system through the UML class diagram, a UML sequence diagram is designed for showing the dynamic behaviour of the above said work represented in Fig. 2, where the patients have arrived to the Govt._Lab for their registration and testing COVID-19. The sequence diagram shows the complete process of patient diagnostic and testing system for COVID-19 affected persons. There are four major objects named Patient, Govt._Lab, Central_Got_Lab and COVID_Center. These objects are communicated with each other through the communication message which is represented by solid arrow and they replied through the dotted arrow along with the reply message. The patient went to the Govt._Lab for registered and give sample for testing whether the person is COVID-19 Positive or not. The collected samples of the person by the Govt._Lab is sent to the Central_Govt._Lab for RT-PCR testing that confirming the status of the person and send back the results of the samples to the Govt._Lab as well as to the person. If the person is COVID-19 Positive then the official of Govt._Lab called the person on their registered mobile number and asked them to the condition, if the condition of person is critical then the person is referred to the COVID-19 centre where the person is admitted and treated.
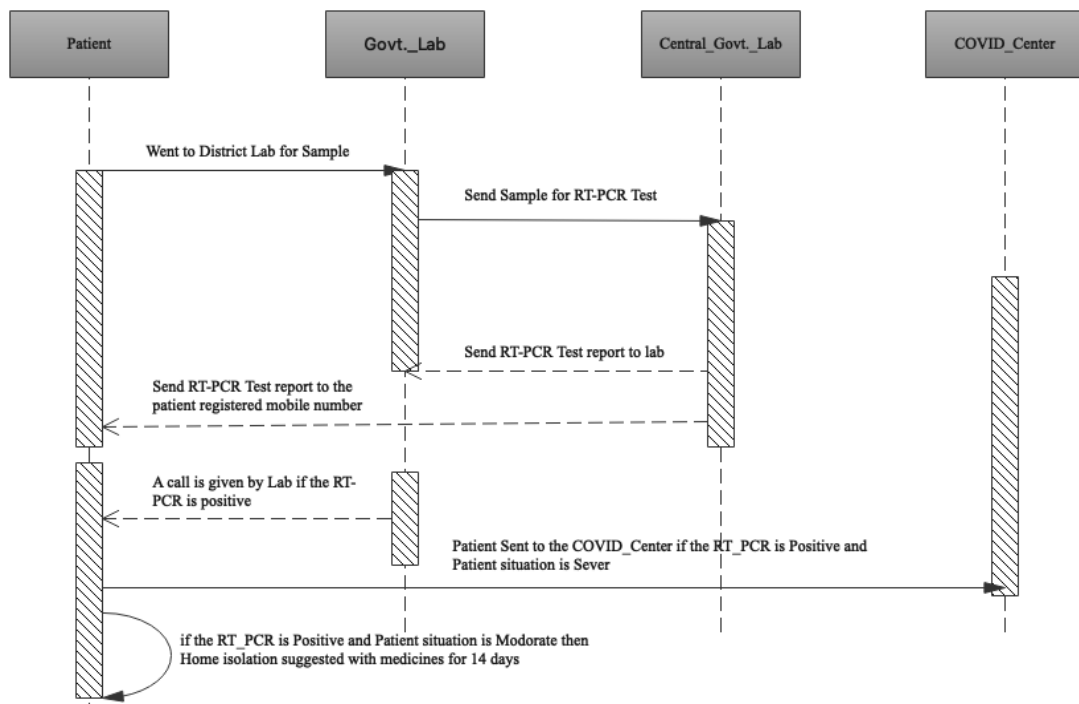
Fig. 2. UML Sequence Diagram for COVID-19 Patient Diagnostic System

Modeling of Fuzzy Object Oriented Database

Fuzzy Object Oriented Database (FOOD) is the database model, which allows complex objects and various hierarchies like aggregation, generalization and inheritance to be implemented on the database. Along with it various types of uncertainties present in the data can be well handled by the proposed model. Due to the implementation of fuzziness, the proposed model is enhanced to access the objects fast from the database. To increase the performance based on speed to access the objects from FOOD model. Unclear and inconsistent information is handled by the most promising database i.e. the fuzzy database. An extension of the fuzzy database is fuzzy object-oriented database (FOOD) that also deals with the vague or imprecise information as well as it supported the object-oriented programming concepts for storing and interrogating the vague information and turned this vague information into crisp one. Therefore, a fuzzy object-oriented database is designed for the patient diagnostic and testing system (PDST) for **"COVID-19 "** with its range value which is represented in the Table 1. Some fuzzy queries are performed, for that the fuzzy query approach is based on the fuzzy logic.

Fig. 3. Fuzzy Object-Oriented Database Evolution

In the field of clinical sciences, there are such a lot of dubiousness and vulnerability found in the clinical records. In this way, it is exceptionally hard to locate an exact arrangement of a given issue based on dubious information. The procedure of analysis of any infection by utilizing the Fuzzy Logic has a few phases like dubious estimations of manifestations of sicknesses, pathology test results for example surrendered to run, infections signs and so on. The fuzzy object-oriented database gives the opportunity to

speak to and launch that sort of questionable and exact properties esteems and reinforced the relations. By incorporating these linguistic variables and their range values, the Fuzzy Object-Oriented Database (FOOD) has been designed for the patient who suffers from deadly disease called novel corona virus i.e. COVID-19. There are several major fields like PID, Patient_Name, Symptoms, Age, Disease, Linguistic Variable and Fuzzy Value are shown in the database Table 1.

Table 1. Fuzzy Object-Oriented Database for Patient Diagnostics and Testing System

DRSANTOSH-PC.He...em - dbo.Patient

PID	Patient_Name	Age	Gender	Symptoms	Disease	Address	Contact	Remarks
1000211	Kamal Ram	75	Male	Lungs Infaction	COVID-19	709 Sarai Thok E...	9839463499	Not Reovered
1000212	Santosh Kumar	40	Male	Fever and Cold	COVID-19	709 Sarai Thok E...	9839463400	Recovered
1000213	Pooja Soni	36	Female	Cold Fever and ...	COVID_19	Sarai Thok East ...	7007237899	Recovered
1000214	Sushila Devi	60	Female	Cold and Throat ...	COVID-19	Sarai Thok East ...	8876342100	Recovered
1000215	Jyoti Kumari	43	Female	Cold, Cough and...	COVID-19	Sarai Thok East ...	7685300298	Recovered
1000216	Aggrima Chauhan	9	Female	Fever	COVID-19	Sarai Thok East ...	9839463400	Recovered
1000217	Harsha	34	Female	Dry Cough and ...	COVID-19	andra padesh	7899008776	Recovered
1000218	Vijay Anand	55	Male	Cold Cough and ...	COVID-19	Andra Pradesh	8759938023	Death
1000219	Nirmal Singh	105	Male	Lungs Infactions	COVID-19	Bihar	9839556448	Death
1000220	Rama Singh	19	Female	Cough and Fever	COVID-19	Lucknow	8877009875	Cured and Reco...
1000221	Vandana Anuragi	46	Female	Lungs Infactions	COVID-19	Farrukhabad	8768009976	Recovered
1000222	Ramakant	22	Male	Cough and Fever	COVID=19	Chandigarh	7658447221	Death
1000223	Kanika Kapoor	41	Female	drycough and fe...	COVID_19	Lucknow	8897465899	Recovered
1000224	Shahil Siddaqui	65	Male	Lungs Infactions	COVID-19	Mumbai	4477683990	Death
1000225	Kashav Kumar	31	Female	Breathing Problem	COVID-19	Lucknow	9839465577	Recovered

Some sample queries has been performed here such as:
*SELECT * FROM tblPatient WHERE ((Age>=45) AND Dysp_Resp>=0.3 AND Dysp_Resp<=0.1))*
SELECT Patient_Name FROM tblPatient WHERE(Age="Old" , SPO_2= "50%-85%" AND Lungs_Infct >50%)
The result of the above mentioned queries is obtained from the Table 1.

Conclusion

From the above work, it is observed that the fuzzy logic can be implemented easily in any database. Therefore, in this work an attempt is done to represent and eliminate the fuzziness in the database by implementing the fuzzy logics to get the certain result through which a decision is made easily. Hence, a fuzzy object-oriented database is designed here for patient diagnostic and testing system. Some fuzzy queries can be performed here for validating the designed fuzzy object-oriented database and performed well.

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