# Design and development of a database management system for aquatic research data

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## Abstract

Enhancing and digitising aqua farming requires a framework for collecting databases and continuous observing of numerous functional parts of water cultivating. The security and development of customary aquatic cultivating, particularly in precipitous locales with supportable advancement objectives, can benefit from the application of cutting-edge technology that enable data collecting and real-time monitoring. The aqua resources' geotagging and geomapping will be crucial for tracking the species in the amphibian climate. These innovations can follow the wellbeing, position, and development of aquatic species in real time, as well as their feeding habits. Using geographical data, this study suggested an IoT-based architecture for managing the aqua resource for environmental sustainability. The development of a data set for water asset the executives and the electronic system for the fisheries industry based on geoinformation systems (GIS) and geopositioning systems (GPS) were also included in this study. The findings of the fishpond in the cloud server and the database creation for water asset the executives are point by point in the review. The framework incorporates machine learning (ML) to examine sensor and geospatial data in order to detect any deterioration in the quality of the water. This would give policymakers up-to-date information for crucial decisions on the continued development of aquatic species to boost the state's economy and aqua farmers' livelihoods.

**Keywords:** Computer-based information, Databases, Database management system

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## Introduction

Computer-based information technologies are widely employed in today's computing world to assist numerous organisations, private businesses, and academic and educational institutions in managing their information systems and processes. Data management is done using information systems (Vinusha *et al.*, 2024). Databases (DB) are one of the main information sources (Saritha and Gunasundari, 2024). Databases are a complete component of both public and private information systems, and they are becoming increasingly important in a wide range of application areas that use these systems (Lee *et al.*, 2020). Databases now hold vast amounts of data due to the development of computer technology and the extensive use of web technology in many fields (Nair and Rathi, 2023). Managing and utilising the precious data resource is essential for effective issue solving and decision making. Database applications contain a vast number of data objects and express data using reduced constructs (Olenin *et al.*, 2014; Assegid and Ketema, 2023). Numerous application domains make extensive use of relational databases. Every record in a relational database is composed of a certain number of fields, also known as attributes, and is stored in a number of tables, also known as relations (Rao and Tiwari, 2023). Data is described in relational database management systems (RDBMS) using relationships between data that are stored in tables and accessible via relational views or logical queries (Bokingkito Jr and Llantos, 2017). It has been discovered that RDBMSs are particularly effective in retrieving massive amounts of the same kind of data (Angin and Bhargava, 2013). One must create a query in order to retrieve data from a database. The Structured Query Language (SQL) standards serve as the foundation for these queries (Singgalen, 2024). An ANSI standard called SQL is used to access and modify data that is kept in relational databases (Yesmin, 2019). Major database management systems support it, and it is widely used in industry (Lemenkova, 2020). Databases and numerous other areas of vital importance to information technology have seen significant advancements in recent years (Reddy and Verma, 2024; Ferdiansyah *et al.*, 2023).

## Proposed Framework

In addition to these motivating elements, the goal of protecting the significant assets that the majority of current databases represent inspired the creation of the Intelligent Database Interface (IDI) (Zhang *et al.*, 2011).

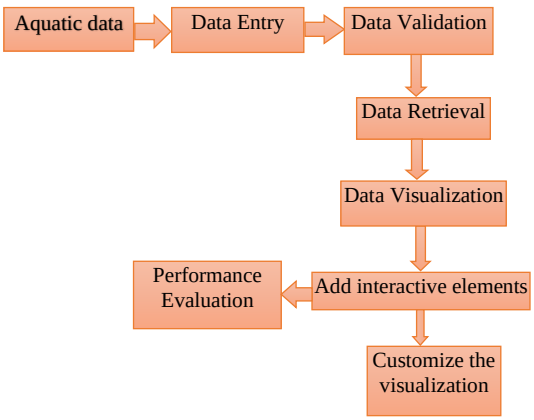


**Figure 1: Overall architecture.**

Figure 1 displays the overall architecture. When employed separately, artificial intelligence and traditional databases have certain inherent flaws. For example, artificial intelligence techniques cannot handle massive data sets, while traditional databases have

little semantic value (Parra *et al.*, 2017). Intelligent database (IDB) systems combine the capabilities of knowledge-based systems (KBSs) and relational database management systems (RDBMSs) to provide a natural approach to handling information, making it simple to save, retrieve, and use (Wang *et al.*, 2023). The intelligent databases must handle extremely complex jobs. These activities entail looking through a large data set seeking and extracting relevant information. With the efficiency or speed that machine intelligences in the form of "intelligent" databases reach, it would be nearly impossible for human minds to derive, induce, or infer any meaningful new data from the enormous data banks (Garces *et al.*, 2006).

## Experimental Results and Discussion

A foundation for the NLIDB "Intelligent Query Convertor," which translates a natural language query into SQL, is created in this study. Since the relational data model is the most popular, it is employed for databases. Figure 2 shows sample database below.


**Figure 2: Sample database.**

Structured Query Language (SQL) is the query language used in relational data models. It is anticipated that this interface will be simple and easy to set up for the specified relational database. Flexible queries are executed and intelligent information processing is carried out by Intelligent Query Converter (IQC). Figure 3 shows the precision recall curve.

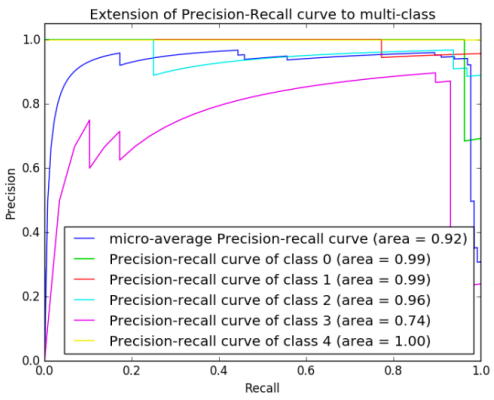


**Figure 3: Precision recall curve.**

The system can be used with any database and can take English-language user input. It creates a relational database engine SQL query. The user receives the result sets from the database engine. A SELECT statement must be constructed in order to access data using a SQL query. This study focusses on the SELECT statement in its most basic form, devoid of any sub-query structure. The sub-query SELECT translation problem is negligible. The rationale is that the validity of the lower sub-query determines whether the nested statement is correct. In order to provide a solid basis for the larger system, it is crucial to develop a system that effectively handles the non-sub-query portion.

## Conclusions

The procedure aids in the study and ongoing tracking of the money spent on various government programs. A constant observing framework will enable future yield prediction, and the framework and application will facilitate resource management. By connecting ranchers with purchasers and following the advancement of their mass items, the proposed smartphone app will enhance farmers' financial circumstances. With the help of a cloud server-based continuous checking framework, the recommended structure for aqua resources makes it possible to collect databases and implement appropriate protocols for tracking the work in various stages. The graphical user interface offered by the suggested aqua farming data generating procedure simplifies it for various officials in their assigned locales to protect the various lake particulars. The method helps with the review and ongoing checking of the cost-effective distribution using a number of schemes. The application and framework will be helpful in the future for tracking the proper use of resources and expenditure utilisation. By connecting farmers and buyers and tracking product growth, the suggested smartphone app will immediately improve their financial circumstances.

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