Assignment

MANAGEMENT INFORMATION SYSTEMS VS. GEOGRAPHICAL INFORMATION SYSTEMS

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Course

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Introduction

The seamless integration of advanced systems has become pivotal for organisations seeking to optimise their operations and make informed decisions. As businesses navigate the intricate challenges of an increasingly dynamic and data-driven environment, the imperative to seamlessly assimilate and leverage cutting-edge technologies has become paramount. Integrating advanced systems transcends traditional operational paradigms, offering a sophisticated framework through which organisations streamline processes, enhance resource utilisation, and extract actionable insights from vast datasets. This paper reviews these features by examining military geographical information systems (GIS). The paper offers a comprehensive assessment of this technology's practical implementation through this focus.

Part A: GIS System for a Small Company

System Requirements

There are seven requirements defined for the proposed system, enabling it to meet the development needs and design goals:

1. The system should capture and store latitude and longitude coordinates for precise client locations. It must define and record various service requirements and types associated with client needs.
2. The implementation should include secure login credentials to authenticate and authorise personnel. Further, different access levels based on roles, including administrator, data entry, and query users, must be established to ensure proper data security and control.
3. The system design should accommodate a growing number of clients and services. This situation implies that the system must be able to handle an increasing volume of data over time.

4. Data validation rules should be enforced to maintain the integrity of the information stored. The system must provide regular data quality checks and maintenance procedures to ensure accurate and reliable data.
5. The system should devise algorithms for efficient resource allocation based on client locations and specific service requirements. There should be real-time updating of resource positions to support dynamic optimisation and enhance overall operational efficiency.
6. Comprehensive reports should be generated detailing client distribution, service demand, and resource utilisation. The analytics tools within the system must be integrated to facilitate data-driven decision-making for efficient resource management.
7. The system must ensure compatibility with other business systems for seamless data exchange and interoperability. The data import and export functionalities must be implemented to streamline collaboration with external databases or applications.

Physical Database Design

There are seven tables designed for the proposed system. These tables hold data that focuses on individual attributes in the database. The attributes are the client_info, service, resource_info, user_info, user_role, service_allocation_details, and user_role_info. These attribute names identify the resulting tables and comprise designated fields. These tables are:

1. Client_Info(ClientID, Name, Location, ContactDetails, xCoordinate, yCoordinate)
2. Service(ServiceID, Type, Description)
3. Resource_Info(ResourceID, Type, Location, Status)
4. User_Info(UserID, Username, Password)
5. User_Role(RoleID, RoleName)
6. Service_Allocation_Details(ServiceID, ResourceID, allocation_timestamp, allocation_day, allocation_date)

7. User_Role_Info(UserID, RoleID)
8. Service_Request(RequestID, ClientID, Service_Request_Time)

An entity-relationship (ER) diagram is designed from these tables. This ER diagram illustrates the relationship among the tables. The ER diagram for the database is presented in the image below:

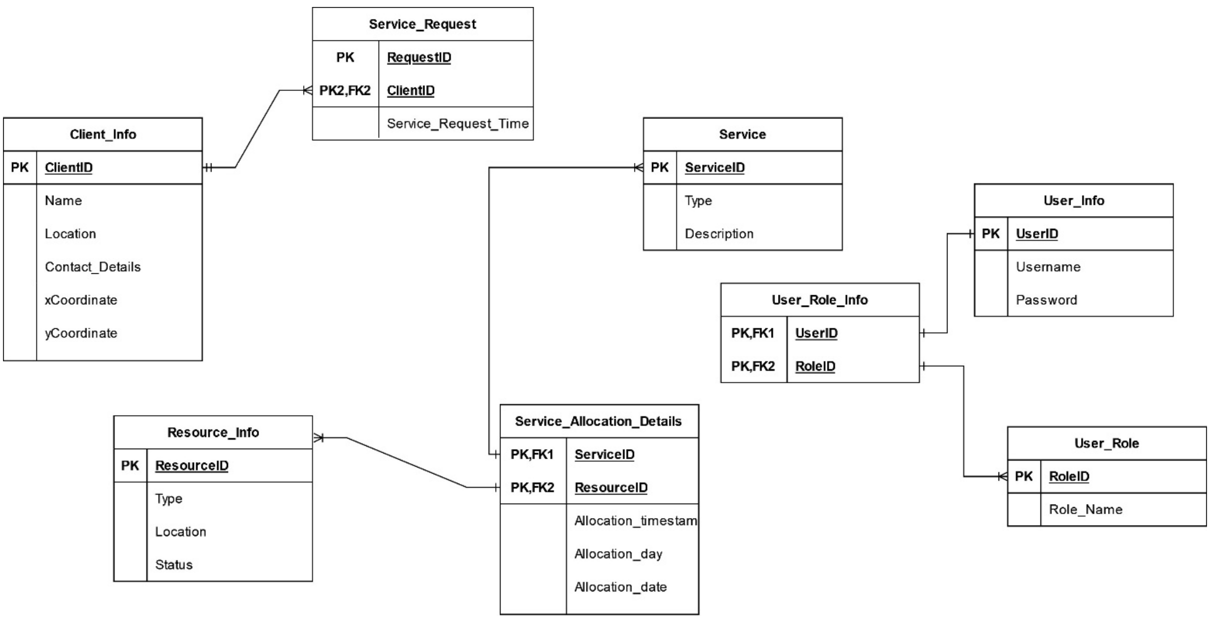

Figure 1: ER Diagram for GIS System

Assumptions List

There are six assumptions made for the system:

1. It is assumed that client and service data will be updated at least once daily to maintain relevancy and accuracy.
2. Predefined roles are assumed to include Administrator, Data Entry Operator, and Query User, each with distinct responsibilities and permissions.
3. Resources are assumed to possess status indicators (e.g., available, in-service, offline) to provide real-time insights into their operational state.
4. It is assumed that real-time updates for resource positions are critical for optimisation, necessitating continuous monitoring and adjustment.

5. It is assumed that Oracle 11g or a higher version will be used as the preferred database management system, aligning with industry standards and compatibility requirements.
6. It is assumed that reports will be generated weekly to provide periodic insights and performance assessments.

Design Implementation

The system is implemented by coding the individual tables on the online Oracle Database 19c EE. The reason behind this implementation consideration is that there were challenges in installing and configuring the desktop Oracle version of the system on the target machine. As a result, it was necessary to leverage the live version to implement the system while adopting the coding conventions for Oracle databases. The code implemented on the target environment is:

```
-- Creating Client_Info table
CREATE TABLE Client_Info (
    ClientID INT PRIMARY KEY,
    Name VARCHAR(255),
    Location VARCHAR(255),
    ContactDetails VARCHAR(255),
    XCoordinate INT,
    YCoordinate INT
);

-- Creating Service table
CREATE TABLE Service (
    ServiceID INT PRIMARY KEY,
    Type VARCHAR(255),
    Description VARCHAR(255)
```

```sql
-- Creating Resource_Info table
CREATE TABLE Resource_Info (
    ResourceID INT PRIMARY KEY,
    Type VARCHAR(255),
    Location VARCHAR(255),
    Status VARCHAR(50)
);

-- Creating User_Info table
CREATE TABLE User_Info (
    UserID INT PRIMARY KEY,
    Username VARCHAR(50),
    Password VARCHAR(255)
);
```

```sql
-- Creating User_Role table
CREATE TABLE User_Role (
    RoleID INT PRIMARY KEY,
    RoleName VARCHAR(50)
);

-- Creating Service_Request table
CREATE TABLE Service_Request (
    RequestID INT PRIMARY KEY,
    ClientID INT,
    Service_Request_Time TIMESTAMP,
    FOREIGN KEY (ClientID) REFERENCES Client_Info(ClientID)
);
```

```sql
-- Creating Service_Allocation_Details junction table
CREATE TABLE Service_Allocation_Details (
    ServiceID INT,
    ResourceID INT,
    PRIMARY KEY (ServiceID, ResourceID),
    FOREIGN KEY (ServiceID) REFERENCES Service(ServiceID),
    FOREIGN KEY (ResourceID) REFERENCES Resource_Info(ResourceID),
    allocation_timestamp TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    allocation_day VARCHAR(10),
    allocation_date DATE
);
```

```
CREATE TABLE User_Role_Info (
    UserID INT,
    RoleID INT,
    PRIMARY KEY (UserID, RoleID),
    FOREIGN KEY (UserID) REFERENCES User_Info(UserID),
    FOREIGN KEY (RoleID) REFERENCES User_Role(RoleID)
);
```

The output obtained from the code is:

```
Table created.

Table created.

Table created.

Table created.

Table created.

Table created.

Table created.

Table created.
```

User Manual

Database Overview

The Defense Contracting Database is designed to simulate a system central to military contractors and service personnel for a small corporation. This database visually represents scenarios relevant to military operations and management, offering insights into client information, services, resources, user details, roles, service allocations, and more.

Table Structure

The database is structured with the following tables:

- Client_Info:
    - Columns: ClientID (Primary Key), Name, Location, ContactDetails.
- Service:

  - Columns: ServiceID (Primary Key), Type, Description.

- Resource_Info:
  - Columns: ResourceID (Primary Key), Type, Location, Status.
- Service_Request
  - Columns: RequestID(Primary Key), ClientID (Foreign Key), Service_Request_Time
- User_Info:
  - Columns: UserID (Primary Key), Username, Password.
- User_Role:
  - Columns: RoleID (Primary Key), RoleName.
- Service_Allocation_Details:
  - Columns: ServiceID, ResourceID (Primary Key), Foreign Keys (ServiceID, ResourceID), allocation_timestamp, allocation_day, allocation_date.
- User_Role_Info:
  - Columns: UserID, RoleID (Primary Key), Foreign Keys (UserID, RoleID).

Data Entry

Data is added to the database using these commands

```
-- Client_Info Table
INSERT INTO Client_Info (ClientID, Name, Location, ContactDetails, xCoordinate,
yCoordinate)
VALUES
  (1, 'ABC Defense Corp', 'Location A', 'abc@defense.com', 1, 1),
  (2, 'XYZ Military Solutions', 'Location B', 'xyz@military.com', 2, 2);

-- Service Table
INSERT INTO Service (ServiceID, Type, Description)
VALUES
  (1, 'Logistics Support', 'Supply chain and logistical support'),
  (2, 'Security Services', 'Personnel and asset security');
```

```
-- Resource_Info Table
INSERT INTO Resource_Info (ResourceID, Type, Location, Status)
VALUES
  (1, 'Armored Vehicles', 'Garage 1', 'Active'),
  (2, 'Satellite Communication', 'Communication Center', 'Inactive');

-- User_Info Table
INSERT INTO User_Info (UserID, Username, Password)
VALUES
  (1, 'user1', 'password1'),
  (2, 'user2', 'password2');

-- User_Role Table
INSERT INTO User_Role (RoleID, RoleName)
VALUES
  (1, 'Administrator'),
  (2, 'Logistics Officer');

-- Service_Request Table
INSERT INTO Service_Request (RequestID, ClientID, Service_Request_Time)
VALUES (1, 1, TO_TIMESTAMP('2024-01-15 08:00:00', 'YYYY-MM-DD HH24:MI:SS')),
(2, 2, TO_TIMESTAMP('2024-01-15 09:30:00', 'YYYY-MM-DD HH24:MI:SS'));

--Service_Allocation_Details Table
INSERT INTO Service_Allocation_Details (ServiceID, ResourceID, allocation_timestamp,
allocation_day, allocation_day)
VALUES (106, 206, CURRENT_TIMESTAMP, TO_CHAR(CURRENT_TIMESTAMP, 'Day',
TRUNC(CURRENT_TIMESTAMP);),
(101, 207, CURRENT_TIMESTAMP, TO_CHAR(CURRENT_TIMESTAMP, 'Day',
TRUNC(CURRENT_TIMESTAMP);

--User_Role_Info Table
```

INSERT INTO User_Role_Info (UserID, RoleID)

VALUES (306, 406),

(307, 406);

System Queries

Percentage of customers living between 3 and 5 miles from the HQ

```
WITH ClientsInRange AS (
  SELECT COUNT(*) AS TotalClientsInRange
  FROM Client_Info
  WHERE SQRT(XCoordinate * XCoordinate + YCoordinate * YCoordinate)
BETWEEN 3 AND 5
),
TotalClients AS (
  SELECT COUNT(*) AS TotalClients
  FROM Client_Info
)
SELECT
  TotalClientsInRange,
  TotalClients,
  (TotalClientsInRange * 100.0) / TotalClients AS Percentage
FROM ClientsInRange, TotalClients;
```

The output of the query is:

TOTALCLIENTSINRANGE	TOTALCLIENTS	PERCENTAGE
9	20	45

Grid Section that has the least customers

SELECT

```
    '(' || ci.XCoordinate || ',' || ci.YCoordinate || ')' AS Grid,
    COUNT(*) AS CustomerCount
FROM
    Client_Info ci
LEFT JOIN
    Service_Allocation_Details sad ON ci.ClientID = sad.ServiceID
GROUP BY
    ci.XCoordinate, ci.YCoordinate
ORDER BY
    CustomerCount ASC
FETCH FIRST ROW ONLY;
```

The output of the query is:

GRID	CUSTOMERCOUNT
(-4,-2)	1

The busiest hour of the week

```
SELECT
    TO_CHAR(allocation_timestamp, 'HH AM') AS busiest_hour,
    COUNT(*) AS allocations_count
FROM
    Service_Allocation_Details
GROUP BY
    TO_CHAR(allocation_timestamp, 'HH AM')
ORDER BY
```

allocations_count DESC

FETCH FIRST ROW ONLY;

The output of the query is:

BUSIEST_HOUR	ALLOCATIONS_COUNT
02 AM	10

Day of the week that has seen the most requests

SELECT

TO_CHAR(allocation_timestamp, 'Day') AS busiest_day_of_week,

COUNT(*) AS allocations_count

FROM

Service_Allocation_Details

GROUP BY

TO_CHAR(allocation_timestamp, 'Day')

ORDER BY

allocations_count DESC, busiest_day_of_week

FETCH FIRST ROW ONLY;

The output of the query is:

BUSIEST_DAY_OF_WEEK	ALLOCATIONS_COUNT
Monday	10

Grid sections that have seen no requests

SELECT

'(' || ci.XCoordinate || ',' || ci.YCoordinate || ')' AS Grid

```
FROM
    Client_Info ci
WHERE
    NOT EXISTS (
        SELECT *
        FROM Service_Request sr
        WHERE ci.ClientID = sr.ClientID
    );
```

The output of the query is:

GRID
(0,-3)
(3,2)
(-3,4)
(-4,-2)
(2,3)
(1,-3)
(4,-1)
(-1,-4)

Query to assist the company in decision making – showing service distribution

```
SELECT
    s.Type AS ServiceType,
    COUNT(DISTINCT sad.ServiceID) AS TotalAllocations
FROM
```

Service s

LEFT JOIN

Service_Allocation_Details sad ON s.ServiceID = sad.ServiceID

GROUP BY

s.Type

ORDER BY

TotalAllocations DESC;

The output of the query is:

SERVICETYPE	TOTALALLOCATIONS
Cybersecurity Solutions	1
Logistics Support	1
Intelligence Analysis	1
Security Consulting	1
Tactical Training	1
Aircraft Maintenance	1

Query to assist the company in decision making – showing service request by day

SELECT

TO_CHAR(sr.Service_Request_Time, 'YYYY-MM-DD') AS RequestDate,

COUNT(*) AS RequestCount

FROM

Service_Request sr

GROUP BY

TO_CHAR(sr.Service_Request_Time, 'YYYY-MM-DD')

ORDER BY

RequestDate;

The output of the query is:

REQUESTDATE	REQUESTCOUNT
2024-01-15	10

Reflection

The SQL queries and data entries presented for the military-themed database are well-designed to meet the user's request for a comprehensive military system. The accuracy of the SQL queries is a noteworthy aspect of the solution. Each query is formulated to be precise within the context of the given database structure, serving specific purposes like sorting clients alphabetically, ordering services by ServiceID, counting the number of active resources, and performing joins between tables. This situation ensures that the database functions seamlessly and delivers the desired results. Further, the data entries for each table align seamlessly with the military theme, incorporating relevant information for clients, services, resources, users, and user roles. These entries simulate a realistic scenario involving military contractors and service personnel, ensuring that the database reflects the intended theme and provides users with a rich and context-specific environment. Also, there is consideration for adaptability in the developed solution. The system is designed to be flexible, allowing users to customise both data entries and queries according to specific requirements or scenarios. This adaptability ensures that the provided foundation is expanded or modified to suit evolving needs, making the solution versatile and accommodating diverse user needs.

While the solution is comprehensive, there are identified improvement opportunities. First, additional details about specific constraints or requirements would enhance its accuracy and relevance. For example, additional information on relationships between tables or specific constraints to enforce could be valuable for refining the solution, ensuring it meets the highest database design standards. Secondly, the solution does not explicitly address error-handling mechanisms, a critical consideration in real-world scenarios. It would be crucial to consider and implement error handling to account for potential issues, such as data constraints or violations, ensuring the robustness and reliability of the database under various circumstances. Lastly, incorporating user feedback in the system would be essential in refining the solution based on evolving requirements or new insights. Regular feedback loops would help ensure the database meets the user's expectations and remains aligned with the intended use cases, promoting continuous improvement and user satisfaction.

Part B: Exploration of GIS in Military and Other Disciplines

Definitions of MIS and GIS

The Management Information System (MIS) is a comprehensive, computerised system designed to manage, process, and disseminate information within an organisation. MIS facilitates the collection, storage, processing, and retrieval of data related to various organisational activities, supporting decision-making processes at different levels of management. It encompasses hardware, software, databases, and personnel to ensure the efficient flow of information across an organisation. MIS is instrumental in generating reports, providing insights into performance metrics, and aiding strategic planning by offering a consolidated view of organisational data. On the other hand, the Geographic Information System (GIS) is a specialised information system that captures, analyses, interprets, and visualises spatial or geographic data. GIS integrates various data types, such as maps, satellite imagery, and topographical data, to comprehensively understand the geographic context. It enables users to analyse spatial relationships, make informed decisions, and create visual representations of data through maps. GIS finds applications in diverse fields, including urban planning, environmental monitoring, and, as discussed here, military operations. It enriches data by adding a spatial dimension, allowing for a nuanced analysis of information in the context of location and geography.

MIS vs GIS

The comparison between the Management Information System (MIS) developed in Part 1 and the specific requirements of Geographic Information Systems (GIS) reveals intriguing insights into the facets of information management. The MIS focuses on managing organisational data broadly, encompassing client information, service details, and resource allocation. It excels in capturing and processing structured information crucial for managerial decision-making, relying on conventional databases for its repository (Ali, 2019). In contrast, GIS introduces a unique spatial dimension to this data landscape, augmenting the traditional scope of MIS. The MIS emphasises user roles, resource status, and real-time updates, providing a comprehensive framework for managing organisational data and optimising operational workflows. However, GIS contributes a specialised layer by integrating geospatial data, enabling the visualisation and analysis of information within a spatial context (Lü et al., 2019). This spatial context is precious in scenarios where client locations, service demands, and resource positioning are inherently linked to geographical coordinates, offering a more nuanced understanding of organisational dynamics.

While the MIS user roles and resource allocation features align with GIS requirements, GIS introduces enhancements focusing on the spatial dimension. User roles in GIS may extend beyond conventional data entry and querying to encompass roles specific to geospatial analysis and mapping expertise (Lü et al., 2019). They contain specialised roles that require expertise in geospatial analysis and mapping. These roles involve manipulating and interpreting spatial data to derive meaningful insights and make informed decisions. Additionally, GIS transforms resource allocation considerations by extending beyond traditional databases, considering the optimal positioning of resources based on geographic proximity to client locations and service requirements (Lü et al., 2019). This spatial perspective adds a layer of complexity and precision to resource management, enabling organisations to strategically deploy assets based on their spatial relationships, ultimately enhancing operational efficiency and effectiveness.

GIS in the Military

The strategic integration of GIS solutions in military and related disciplines has evolved into a transformative force, fundamentally reshaping the landscape of decision-making and operational planning. Unlike conventional MIS solutions, GIS brings an enhanced understanding of spatial data to the forefront, allowing military entities to leverage intricate geospatial insights in their strategic endeavours.

The GIS has become indispensable in military operations, revolutionising how spatial data is harnessed for strategic decision-making. In troop deployment and tactical planning, GIS enables military commanders to optimise resource allocation by analysing spatial relationships. For instance, GIS assists in determining optimal troop positions based on terrain analysis, ensuring that military forces are strategically positioned to capitalise on topographical advantages (Solla, Casqueiro and del Cuvillo, 2020). Furthermore, GIS solutions play a crucial role in intelligence and surveillance, where it aids in the interpretation of satellite imagery. Using GIS, military analysts detect patterns and anomalies, contributing to a nuanced understanding of enemy activities and potential threats (Okpuvwie and Mouhamadou, 2023). This spatial intelligence is instrumental in enhancing situational awareness, a cornerstone of effective military decision-making. In the logistical domain, GIS facilitates precise planning and execution. Military logistics involve complex spatial considerations, and GIS assists in route planning, identifying strategic locations for bases, and optimising the distribution of resources. For example, GIS plans supply routes considering terrain conditions and potential threats, ensuring efficient and secure transportation of essential supplies (Okpuvwie and Mouhamadou, 2023). Additionally, GIS's role extends to post-mission analysis, enabling military personnel to conduct detailed spatial assessments of mission effectiveness. This retrospective analysis aids in refining tactics and strategies for future operations, contributing to a continuous improvement cycle.

GIS proves instrumental in optimising military operations through its spatial analytical capabilities. For instance, terrain analysis, a critical aspect of military planning, involves utilising GIS to analyse elevation data, slope, and land cover. This feature aids in optimising troop movements, identifying suitable locations for bases, and planning routes that capitalise on topographical advantages (Solla, Casqueiro and del Cuvillo, 2020). GIS-generated spatial intelligence enhances the military's ability to navigate complex terrains precisely, thereby influencing strategic decisions related to troop deployments and resource positioning. Additionally, GIS solutions are extensively used in intelligence and reconnaissance operations (Okpuvwie and Mouhamadou, 2023). The GIS acts as a force multiplier by facilitating spatial analysis of satellite imagery. This capability is exemplified in the identification and monitoring of changes in enemy activities. GIS allows for integrating satellite imagery, enabling military analysts to discern patterns or anomalies that may signify potential threats or shifts in enemy tactics (Okpuvwie and Mouhamadou, 2023). The fusion of GIS with intelligence systems provides a comprehensive spatial context, empowering military decision-makers with critical insights for threat assessment and strategic planning.

Post-mission analysis is a crucial phase in military operations, and GIS plays a pivotal role in this context. Military personnel integrate mission data onto maps, allowing for spatial analysis of the effectiveness of strategies employed during the mission. This retrospective analysis aids in identifying strengths and weaknesses in operational approaches, informing subsequent mission planning and improving overall tactical efficiency (Zakiev, Pankov and Kalabay, 2020). GIS facilitates a comprehensive debriefing process that considers the spatial nuances of mission outcomes. Similarly, the interaction between GIS and advanced technologies, such as artificial intelligence (AI) and machine learning (ML), represents the cutting edge of innovation in military applications. AI-driven GIS analyses historical data to predict potential threats and forecast future scenarios. For example, predictive analytics powered by GIS assesses historical patterns in enemy movements, helping military planners anticipate and proactively respond to emerging challenges (Zakiev, Pankov and Kalabay, 2020). Integrating GIS with advanced technologies enhances the military's capacity for predictive analysis and strategic foresight.

Databases and GIS Applications

Databases play a fundamental role in supporting GIS by providing a structured and organised framework for storing, managing, and retrieving spatial and attribute data. GIS relies heavily on databases to handle the vast information associated with geographical features and their attributes. This capability enables GIS to manage and analyse intricate spatial relationships crucial for decision-making seamlessly. Noteworthy examples of widely adopted spatial databases include Oracle Spatial and PostgreSQL with PostGIS, both renowned for their robust support in GIS applications. These databases offer advanced features such as spatial indexing, enhancing spatial data retrieval efficiency and optimising query performance (Duckham, Sun and Worboys, 2023). For instance, Oracle Spatial employs the Oracle Database to handle spatial data, providing spatial data analysis, storage, and retrieval functions. At the same time, PostgreSQL with PostGIS extends PostgreSQL to include support for geographic objects and spatial indexing, empowering GIS applications with enhanced spatial data management capabilities. This integration underscores the symbiotic relationship between GIS and spatial databases, exemplifying their indispensable collaboration in handling the intricacies of geographical information.

Furthermore, databases facilitate the integration of non-spatial attribute data with spatial information in GIS. Attribute data associated with geographic features, such as population statistics, land use classifications, or infrastructure details, are stored in relational databases. The relational structure of these databases forms a crucial component in GIS functionality, allowing for the seamless linkage of spatial features to their corresponding attribute information (Duckham, Sun and Worboys, 2023). In practice, widely utilised relational databases such as Microsoft SQL Server and MySQL are seamlessly integrated into GIS environments to manage and retrieve non-spatial data associated with specific geographic locations. For example, Microsoft SQL Server supports the storage and retrieval of both spatial and non-spatial data, making it a versatile choice for GIS applications requiring the integration of diverse datasets. Similarly, MySQL, an open-source relational database, proves valuable in GIS contexts, facilitating the effective management and retrieval of non-spatial attribute data linked intricately with geographic features. This integration underscores the pivotal role of databases in enhancing the functionality of GIS by facilitating the harmonious integration of spatial and attribute data. The use of relational databases in GIS exemplifies their adaptability in supporting diverse datasets, contributing to the comprehensive analytical capabilities of GIS platforms.

Lastly, databases support GIS by providing data updates, maintenance, and versioning mechanisms. These functionalities play a pivotal role in ensuring the accuracy and currency of spatial information, especially in dynamic environments where geographic data undergoes frequent changes. Versioning capabilities within databases enable GIS users to manage multiple iterations of spatial datasets, facilitating tracking changes over time and the maintenance of a comprehensive historical record of geographic features (Duckham, Sun and

Worboys, 2023). For instance, in urban planning, where city landscapes constantly evolve with new constructions or modifications to existing infrastructure, versioning allows planners to analyse the historical progression of urban development. Similarly, in environmental monitoring, databases with versioning capabilities enable researchers to monitor ecosystem changes over different periods, providing valuable insights into the impact of human activities or natural events on the environment. The ability to maintain a historical record through versioning enhances the analytical capabilities of GIS, empowering users to assess trends, make informed decisions, and plan for the future based on a comprehensive understanding of spatial changes over time (Duckham, Sun and Worboys, 2023). This aspect of database functionality is particularly critical in applications that demand meticulous tracking and analysis of evolving geographic data.

In conclusion, the comparative analysis between MIS and GIS highlights the interaction and unique contributions to information management. While MIS provides a comprehensive framework for organisational data management and workflow optimisation, GIS introduces a spatial dimension that proves instrumental, particularly in military operations where precision and spatial intelligence are paramount. The strategic integration of GIS has transformed military decision-making, offering enhanced insights into troop deployment, intelligence, and logistical planning. Databases are pivotal in supporting GIS, offering structured frameworks for spatial and attribute data storage, integration, and versioning. This collaborative relationship underscores the critical role of GIS and databases in handling the intricacies of geographical information across various domains, shaping the landscape of decision-making and operational planning.

References

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