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BUILDING E-GOVERNMENT SOLUTION SYSTEM WITH INTEROPERABLE GIS SOLUTIONS USING BLOCKCHAIN DRIVEN NHIBERNATE MAPPER

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Master of Science

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by

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Nawar Abdulridha Yahya AL-KHAFAJI

DEDICATION

I devote and pledge this research work to my supervisor who is salient for guiding me through whole research work as well as my family for always assisting me in my hard time.

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ABSTRACT

BUILDING E-GOVERNMENT SOLUTION SYSTEM WITH INTEROPERABLE GIS SOLUTIONS USING BLOCKCHAIN DRIVEN NHIBERNATE MAPPER

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As services are increasingly offered through the global website, efforts by both academia, practitioners, and industry are aimed at creating technologies and standards that meet modern web applications and users' sophisticated requirements. In this study we introduce BlockData: a modular and tamper-resistant system that uses the advantages of data log layout and blockchain security guarantees for secure and sensitive data logs. To this end, we construct and outline the design schema for BlockData. We apply our design to Hyperledger and evaluate the network latency, payload performance and network size. Our findings demonstrate that traditional audit logs can be transferred smoothly to the block audit to improve safety, honesty and tolerance for failures. For various operating platforms, the technical environment for system design ensures flexibility and interoperability.

Keywords: Blockdata, Global Website, Blockchain, Hyperledger.

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LIST OF ABBREVIATIONS

GIS	:	Geographic Information System
OBD	:	On-Board Diagnostics
SDI	:	Serial Digital Interface
ORM	:	Read-Only Memory

1. INTRODUCTION

GIS is a geographical information system, often called a computerized data base management system utilized to store, retrieve, display, and evaluate spatial information. GIS is an abbreviation for geographic information systems. Any data that contains locality information–a zip code, street address, coordinates of longitude and latitude and tract census–can be considered spatial. Most variety data types can be incorporated into GIS and displayed as a map contour. Spatial patterns and relations often emerge when these lays are drawn up on each other. The most prevalent GIS outcome is a map, although GIS can be employed as a part of the space statistical analysis or as part of query answers [1].

The data based on geographical features can be recorded, analyzed, displayed and managed using GIS integrated hardware, software and data. The visualization, understanding, questioning, interpretation of GIS information via the internet is possible in different ways, in the form of maps, globes, reports and charts that reflect relationships, patterns and trends. All these data can be easily and rapidly shared. In many organizational information systems, such as government, universities, companies, etc., GIS technology can also be used [2]. The advantages of GIS can be taken by various users in accordance with their unique requirements. Some users, for example, wish to visualize special objects with geographical characteristics or context features, others can use GIS for context - based analysis and decision - making, while some organizations and the government can utilize GIS for predictions of natural hazards and emergency responses and rescues [3].

GIS are broadly utilized at present to change the world we see and overcome barriers. GIS is widely used. Countries set up their own SDI and share geospatial information globally [4]. The countries are developing SDI. Nationally and globally, certain standards of information sharing have been created that increases the compatibility and interoperability of GIS data. This interoperability allows for the sharing of information and improves the users experience. The advantages of GIS today are benefitting people, such as increasing efficiencies and cost saving, by improving the maintenance of certain geo - areas, making decisions with regards to location in the sphere of real - estate sites and selecting a route, evacuation planning and removal of natural resources. For the purpose of database management, we consider that components have both geographical and contextual attributes; one item is, for instance, a residential building; its geographical features are longitudinal and latitude characteristics (34 ° 54' in terms of latitude, 118

° 34' east in terms of longitude). We can easily elucidate on locations of resources and also record pertinent volumes and distribution through geographical attributes. We can evaluate associated contexts and take advantageous resolutions with context attributes. By looking via GIS, we can identify trends and patterns of objects to influence decision making over a period of time.

Spatial objects (SObj-s) are defined in specific locations that have attributes of geographic and contextual characteristic, such as streets, rivers, maps, buildings, and parks. These features can be utilized to evaluate objects. When defining a SObj, there is need to provide certain appropriate attributes in terms of granularity, which may include object owner, geo reference, object context, object enlargement, and levels etc. So as to supply complete information service and allow better decision making, the GIS SObj-s can be located across a network with various data supplies resources that are useful because the GIS data required is extremely extensive and particularly detailed and needs to be supported by sharing and outsourcing [5]. With regard to the provision of information from SObj, information providers and security of information transmission should be taken into account. In this respect we need to give people who can read, write, modify or delete data a role and authorization. Users must also permission to read, write, modify, zoom in or out, and delete because the data is sensitive and confidential. In that way, they can obtain reliable data and decision making based on this information. The data concerned are classified into the repository in various conditional forms, such as quality, economic contexts, government contexts, and utility contexts etc., to manage SObj's and supply context evaluation information. In the meantime, geographical and demographic information should be made available and can be retrieved in any context because these data are generally widely used.

But security problems, particularly in public security, military, e-commerce, digital cities, power, and privacy, etc. but also in public management and administration databases or in used for the intelligent Cities [6], are becoming increasingly essential as GIS is developed. Security problems are increasingly becoming essential. Security threats to GIS are recently caused mainly by interceptions and eavesdropping, sniffing, unauthorized access, violent attack, masking, and internal attack. Three general measures have been taken to tackle these threats: spatial access control, security of spatial transmission and repository security for spatial information. Many investigations into the three measures are carried out, but no integrated security technology system ensures GIS security and satisfies the overall and systemic GIS application requirements.

The right of users to access a particular SObj must be monitored for user identification (roles and permissions) so that the confidentiality and sensitivity of GIS SObj-s are protected. Indeed, people can access various data in terms of granularity, with different identifications. Users can access SObj information in a hierarchic fashion on a vertical level, for example in the region, the town and the city. On the horizontal levels, because of the sensitivity and the confidentiality of SObj, users can only access SObj's or some of its attributes. For example, common users can view only the geographical reference and the extensions of a building at the same level, but building managers will be able to access the names of the object owners and the respective government workers can access and alter the tax information of the people present to in the building. Users can access SObj-s in various details, based on their roles and allowances to protect data in selective access modes and improve the GIS security.

There has been a lot of research to discuss the safety of GIS. We examine this research for the first time in the thesis. We then define users, roles and permissions relationships on the basis of which a GIS security framework is proposed. In the design, we consider that various users may be able to access the GIS SObj-s for specialized purposes, generally decision-making in businesses [7] in order to evaluate data in a variety of contexts. For GIS SObj-s users must be defined, in operating modes, for example read, zoom in, write, modify, and delete. We also expect that license issuers have established and assigned roles and permissions to various users on request. The user may operate in vertical hierarchy and in horizontal granularity on the GIS SObj - s under those roles and permissions.

The International Standard Organization considers unified modeling language insert ref to be the industry benchmark for software-intensive system modelling. The research uses UML to outline security to comprehend the security problems of GIS. Class diagrams will be used to show structure and components within SObj-s. Structure and procedure during of GIS systems according to security standards are modeled in the GIS cases, the GIS analysis diagram, UX model and sequence diagrams. GIS should securely and efficiently provide users with all types of information resources requested. GIS requires that different attacks and intrusions are not only prohibited but also that information safety is maintained and recovered when attacked and intruded. In addition, if user’s ingress data by relinquishing a role and permission, GIS shall provide secrecy for the different components.

The aim of this thesis is to develop a roles-based safety design using Nhibernate. After reviewing the status of the investigations and the UML specifications for roles, user access requirements and control are recommended. We also outline how SObj's repository should be managed in relation to context analysis. In addition, we initiate the security access feature, by choosing a certain region and by filtering the pertinent context, to allow users to access more specifically required spatial objects. Finally, the use and specification of the authorization model in a secure GIS architecture is discussed.

In order to store information in the database, most advanced systems use their confidence and standardized query language. Object–Java, C #and C++ programming –orientated languages are the most common languages in system programming. This is because the paradigm-oriented object and relationship databases are founded on a different basis in different specific differences: their implementation and association. In order to address the problem, the mapping tools for objects (OBD) have been designed. Theme of these tools is "the object," which means the relationship impedance "mismatch" theory. The most formidable agents of ORM instruments are NHibernate, Oracle TopLink and a newly developed Microsoft Entiy Framework (EF). On the basis of the Agile software and the database development technique, the ORM tools produce automatic database access layers. Developers of applications are invited to consider data layer objects and connections to these tools. The ORM controls the handling with time of objects and relationships. During committing it tracks and places, updates and automatically deletes the required SQL statements.

NHibernate is an all-embracing, stable and reliable open source framework. It is also suitable for use with Java. It is possible to find NHibernate in the environment of. NET or Java. There are countable commercial tools available to map existing elements and object models from existing databases and map files. This is important in trying to make the legacy database systems standard domain knowledge. These three constituents are sufficient to produce a complete NHibernate data access layer.

The main purpose is to create the NHibernate ORM framework for objects – to– database mapping specifications. The correspondence between the GIS solution model and the database can be automatically determined semi - detailed. Corresponding attributes and columns of the database are established. The tool has a visual foreground, which shows the mapping of Levenshtein distance by heuristic data type. These suggestions have to be tapped by the user interaction to

define final mapping definitions. The XML - based mapping file is also created using defined mapping definitions.

This then increases the costs and difficulty of the attack. The audit log system will effectively improve the overall defense capabilities. This is why we are introducing Block Audit: End-to-end solutions for combining Blockchain systems with audit logs, providing audit logs design capabilities and Blockchain system security guarantees. Block Audit transforms audit logs to a compliant Blockchain information model. This generates and aggregates timestamped data transfers in the audit reports. This uses the BFT protocol to establish consensus amongst the peers on the Blockchain status. The BFT Protocol is energy-efficient. Block Audit is the agnostic software system that offers audit log apps plug and play services.

suggested a stable audit monitoring scheme that could track abuse even after compromise was reached. The audit log attributes must be created before the attack, however, in their process. In contrast, the program does not include a secure way to prevent an assailant from removing and inserting audit files, which in our case Block Audit can quickly detect. The trusted notary tamper-based detection mechanism for RDBMS audit logs was proposed by (Snodgrass, Yao, and Collberg, 2004). A search field will be stored in their system, and when a database is made, RDBMS will receive a time stamp and will compute a hash with the timestamp of the new data. The hash values are then forwarded to the notarial service as a digital document that meets a distinct notary identification. The distinct ID is stored in multiple formats and the ID that you receive by the notary is inconsistent if the attacker alters the timestamp or data.

advanced a blockchain perspective to store the integrity proof digest of the Bitcoin block chain. suggested a monitoring scheme with the aim of promoting the sharing of digital health data in various European countries. proposed a system based on Blockchain for improving security of records. Log integrity checks will be shown in the Blockchain and will withstand log truncation and non-repudiation security log regeneration. Block Audit then produces audit logs by expanding the existing (Nhibernate) ORM, based at ORM, and no other levels of corporate apparition. This makes it easy for existing Block Audit applications.

1.1 NOVELTY

This thesis presents a survey on the Blockchain application in smart cities. The objective of the research is to survey the existing research trends on the applications of Blockchain approaches and

technologies similar to IoT context. Also, how blockchain in smart cities technology can be implemented in keeping track of all communications or transactions between connected devices, blockchain makes use of permanent ledger, which implies it can't be adjusted nor renovated by outside powers, this will help in dispensing with the dangers looked by conventional unified worker models. It tends to be utilized to guarantee security by smart cities or organization web environments, additionally by checking correspondences between associated gadgets on the organization and those gadgets with the more extensive, outside IoT while cutting off access at whatever point a maverick association is distinguished.

In my thesis my primary contribution we introduce BlockData: a modular and tamper-resistant system that uses the advantages of data log layout and blockchain security guarantees for secure and sensitive data logs. To this end, we construct and outline the design schema for BlockData. We apply our design to Hyperledger and evaluate the network latency, payload performance and network size.

1.2 CONTRIBUTION

The purpose of this study is introduce BlockData: a modular and tamper-resistant system that uses the advantages of data log layout and blockchain security guarantees for secure and sensitive data logs in order to ensure that no outside force is able to alter the IIoT data. Hence, the task is to survey, implement, and quantitatively evaluate this system and measure its performance in a typical industrial IoT scenario. We apply our design to Hyperledger and evaluate the network latency, payload performance and network size. The problem is to determine the benefits, drawbacks, and overall performance of the system, as well as how it effects the scalability, response times, and overall quality and effectiveness

2. LITERETURE REVIEW

Security of GIS is a comprehensive and essential affair. GIS security experts currently concentrate primarily on the management of information collaboration, spatial data security, and transmission, user access controls.

The paper discusses a role-based access control standard [8]. They provided a standard model for Nhibernate, designed to perform as a foundation for the creation of new benchmarks in the future, by consolidating ideas from previous Nhibernate designs, research prototypes and commercial prototypes, to solve the problems of uncertainty and confusion. Although often regarded as a single access control and authorization designs, Nhibernate actually consists of several models that are suited to a certain security management application. Nhibernate is a single access control and authentication model. This model is organized in four levels, called flat RCC, hierarchical RCC, restricted Nhibernate and systemic Nhibernate, which are increasing functional capabilities.

In [9], a model of authorization is proposed. This model allows users to securely evaluate the spatial data with regards to the necessary contexts, and analyze them according to users ' responsibility and the categorization model for data security. Users receive vertical authorization for access to specific authorized information in different layers and context permission in a single layer. It is reasonable to select functional data and to make choices on the basis of context analysis.

The SDI Services GeoDRM Simplified Model [10]. Countries have come up with their own SDI and have been corresponding geospatial data around the world. Recently, these advances raised numerous issues of security, privacy and protection. Technology of Digital Rights Management (DRM) have been implemented in the management and control of the use of digital media by averting end users from accessing, copying and converting to other formats. Digital geospatial rights management is a paradigm of a similar kind that tries to incorporate a rights management framework for certain problems with geospatial components. This paper describes details of the SDI Services GeoDRM framework that can be free of the participating elements while still being adequately adaptable to include new and existing benchmarks easily and that also employs open adjustable rights management standards. [11] Analysis of GISS security solutions within the GIS-level architecture. N-tier GIS. The study describes the use of the primary data base security classes for spatial data management. In a database file (FSDB) file system with new and traditional cryptographic algorithms, a new GISS solution has been proposed which provides more secure

and secure spatial file storage and supports consolidated authentication and control access in legacy DSMS systems. Cryptography provisions are discussed in detail as a central topic for many aspects of network security. The paper also describes a number of symmetrical, fast and nonlinear symmetrical, adaptable and fixed key-sized implementation algorithms.

GEO-Nhibernate, an adjunct of the space and location data Nhibernate model, is shown in [12]. Space entities in GEO-Nhibernate are used for designing objects, user localities and geographically limited responsibilities. Based on the user locality, roles are activated. Apart from a physical location taken from a certain mobile terminal (or mobile phone), a logical position and an independent device position (the road, the town or the region) are also allocated to users. They introduced the concept of roles schema to make the model flexible and reusable, which defines the designation of the responsibilities and the form of spatial demarcation responsibilities and the granularity of the rational location. The GEO-Nhibernate has also been expanded to include hierarchy, permission to model, users and heritage activation.

In the Multi-User Geodatabase, [13] exists secure access control. A spatial database access control model is introduced, which allows various users to access default perspectives under their access authorization. This study offers three security frameworks: the single multi-level database, the replicated multi-level database and the single multi-level data base. This article also provides three different security architectures.

Researcher [14] shows encryption in database technique. In the database, data is segregated into non-sensitive data, sensitive data, and user data to conserve time for decryption and encryption. Non-sensitive information is stored directly, but user and sensitive data in symmetrical encryption might be stored and retrieved for their role and permission.

Researcher [15] presents the AES-based signature scheme and the ECC, taking into account the features of the increased capability, sensitivity and confidentiality of spatial data. To ensure that client and server identities are correct and legal, the document provides a digital certificate based identity authentication scheme that not only applies a private key and a unified certificate handling to ensure private keys ' security, but also uses the smaller size ECC certificate and ECC arithmetic benefits to boost security and effectiveness. The paper also contains a scheme of Nhibernate especially implemented in GIS, its approval is adaptable and convenient and meets the needs of spatial co-operative work. Symmetrical AES encryption protects data to guarantee confidentiality and integrity of data during transmission for data protection.

Researcher [16] presents spatial information integration and security. A framework is designed to show how space analytical resources may be incorporated in the decision-making environments, that includes problems of authentication with integrated data. Based upon Web-based technology and services as integration scenarios, architecture and security aspects are considered. It is prospected to incorporate local and web-based data in the Internet-based GIS functionalities in a model of the support for spatial decision. And a framework is developed for the SDSS that demonstrates the efficient deployment of this technology from web-based contexts and functions. In this paper, the integration and safety of spatial information is comprehensively explained and supported decision making and context analysis.

Researcher [17] discusses on the framework for developing smart infrastructure and assessing the precision of locating property as a basis for the integrated smart-city creation framework with all smart-city infrastructures and architecture. The paper also examines the primary benefits of the architecture suggested, including the measurable and immeasurable gains. Increased transparency and decision-making participation is intended as a city with the ability of combining sustainability and competitiveness by incorporating diverse aspects of development and tackling infrastructure investment that can support both the quality of life in the society and economic growth, careful management of natural resources. Introducing the global smart city framework and architecture is the smart city infrastructure. The paper shows how GIS can be used to decide and to develop intelligent cities.

Researcher [18] discusses that a wider applicability of many IT tools plays an important role in business. Retailers need to select new shop venues strategically in a highly competitive retail environment. GIS is a robust IT-tool for position intelligence, with its capacity to control and manage, display and evaluate business data spatially. This study aims to evaluate the option of strategic retail outlets in India's Hyderabad Metropolitan City through the Online Decision Support System (DSS). This process uses web-based geographical information systems (GIS) data, information and software to produce on-line systems for mapping, analysis, and visualization. These processes have been incorporated and synchronized with suitable data layers for better choices (multi-layer system). The DSS fuses several data layers with spatial methodological analysis in order to achieve an ideal retail storage location for possible solutions.

Researcher [19] discussing how a small business ' potential customers can be identified by using geographic information systems. Employers should determine the prospective market for their

ventures, know what unsatisfied requirements their enterprise is modeled to meet, and how potential customers in the target market can meet their requirements. The locality of customers on the prospective market may be very hard due to resource limitations. Nevertheless, GIS was made accessible for small business through the convergence of several trends. GIS can help entrepreneurs to identify where customers are located in a target market. This document applies GIS to the sales data of a startup company to test if GIS fulfills its promise. They suggest that GIS can precisely pin-point the customer location on the prospective market and can forecast past sales. Researcher [18] the traces of mobile elements in a city are being discussed, which show many semantics about city dynamics and human mobility. In this study, they initially provide a short illustration of the data traceability and then outline six research topics in trace evaluation and mining and study the state-of - the-art techniques.

Researcher [19] demonstrates that the recent changing conditions for production and consumption in service environments have changed. This includes unbundling of services resulting from production, growth in the economy and society rich in information, the pursuit of creativity in consumption and service, and the ongoing proliferation of digital technologies. These variations in context impact city administrations because they equip citizens with a variety of welfare services and infrastructure. Ideas such as' smart cities," smart cities' and' know-how cities' create new horizons in an ever more expensive, competitive and environmentally friendly environment for cities to perform their challenging service tasks [20]. In virtually all, they need to portray the cities with reliable information processing, facilitating innovation and creativity, and promoting intelligent and sustainable provisions via service framework. In this research, the subject of smart local public service is discussed [21], commencing from the complexion of services and emerging services economy. A comprehensive system for comprehending the fundamental essence and dimensions of intelligent public services is developed here. Abstraction systemization of critical dimensions for intelligent services and conceptual modelling of intelligent service frameworks are at the center of the focus.

Many people now migrate to towns in villages due to the huge population growth [22] The majority of human civilizations are projected to be concentrated in urban areas very soon. This growing population will have a higher energy consumption and require additional living space. Finally, as the cities grow into metropolises, they leave behind a greater environmental impact. This has taken place worldwide and has led to serious implications [23]. Therefore, a paradigm for the new type

of city, called smart city, has come up to reduce the burden on traditional cities. A clever city employs advanced technology to decrease the environmental impact of human endeavors. More people are also learning how to use handhelds devices and computers as the population is increasing [24]. This has led to a significant number of computers being used in cities. In this research, they postulate an intelligent software that uses a sophisticated system to make the city smart and green with optimum power and hardware resources to decrease the carbon footprint [25].

Researcher [26] shows that the Smart City concept is increasingly considered strategic for resolving issues of irreversible urban growth. Established in the 90's, this term risk becoming too generic and without a common operational definition, in sync with the liberalization of telecommunication and the emergence of internet services. The present paper provides an overview of definition and metric problems in two ways: it derives some methodological propositions from the evaluation to proceed to a strong and reliable Smart City measuring system [27]. Last outcomes are extremely important with a view to the dedicated implementation of the monitoring system.

Researcher [28] illustrate this information, as a chance to address emerging variations and adapt effective decisions, is one of the most vital factors for success in business. This data must be accurate and readily available. The primary objective of this study is to develop a technique for automatic real-world geosimulation based on Geographic Information Systems and statistical data collected, based on adequate geosimulation model preparation [29]. All urban environment structures interact with each other and the urban environment is a network between various structures, links, fluxes and relationships. A road network and transport communication network shall determine the direction of the territory and spatial distribution and development, and business environment development too [30]. Furthermore, city development planning requires up-to-date traffic and peatflow information, as well as local service accessibility information, open territory, etc. The information in GIS models is well formed. Capacity information is also available in most model objects. Since the GIS designs are static, they cannot be utilized to identify territorial dynamics, but the urban conditions are nonlinear [31]. Geosimulation models can be designed to help solve non-linearity, since as they are informative than GIS models for dynamic procedure. Geosimulation designs also enable optimization and experimentations tasks to be resolved. The automatic development of geosimulation designs requires no further profound expertise in the field

of simulation techniques [32]. From an economic point of view, it is distinguished by lower costs, fast data access and greater flexibility.

Researcher [33] propose an approach for user-oriented bus selection (BRT) for the GIS city of Jaipur. The model's purpose is to choose the BRT channel for a horizon year reliant on the spatial distribution of movement in the urban areas. The design utilizes the town's characteristics of demographic, movement and land use to detect the high-speed BRT-course. The methodology includes two models; the first addresses BRT demand forecast, while the second model selects the BRT channel based on certain predefined forms [34]. The design produces GIS - based graphical maps for urban planners to achieve a greater comprehension of the pattern of movement demand and of the policies. The methodology can be used effectively for mass transit planning in any similar city in the Indian context [35].

Researcher shows that the "smart" urban development has emerged as a strategy to mitigate urban population growth and urban planning problems. However, little academic study discussed the phenomenon sparingly. This study offers a system for understanding the ideas of intelligent cities in order to bridge the gap in intelligent town literature and as an answer to the increasing use of the idea [36]. Based on a varied and comprehensive range of literature from different disciplines. Eight key smart-city strategies have been identified: people; management; governance; technology; political context; and communities; economy; building infrastructure; and natural environment. These elements form the foundation of an integrative system to study how local authorities plan intelligent city scheme. The scheme proposes guidelines and strategies for intelligent city study and postulates practical implications for professionals within government [37].

3. METHODOLOGY

In order to provide a free, clear and transparent PPGIS solution.This research, which is responsible, indicates that PPGIS should be established as a On the Ethereum Network DApp. In this respect, the backend is built instead of using the traditional web application architecture. As a module on the server side, centrally mounted on a server computer, we Using smart contracts as the PPGIS framework backend module. A MCDA PPGIS prototype through which users can influence the decision process regarding their city was discussed and built in this study in order to explain the proposed technique. The Participatory Urban Decision-making DApp (PUDD) framework is a framework that can be used within the city to pick participative locations.

3.1 GENERAL OVERVIEW

Whenever a municipality wishes to find a suitable location for a new facility, the process starts. In this regard, a set of suitability requirements for the desired site is specified by the municipality. An external agent extends and implements a new version of Ethereum's PUDD, based on the given criteria, with the requirements The additional requirement of the PUDD will be accessible through the Internet and will allow users to engage in the selection process by determining the significance within each requirement, depending on personal views, as opposed to another attribute. Then using the AHP (analytical hierarchy process) algorithm, PUDD solves the MCDM process. Solving AHP leads to all criteria being weighed. Using the weights, a Map-Server produces a worksite suitability map based on the weights provided by the users. Finally, for the public at large, the suitability map is printed and is also used as a starting point for decision-makers in education systems.

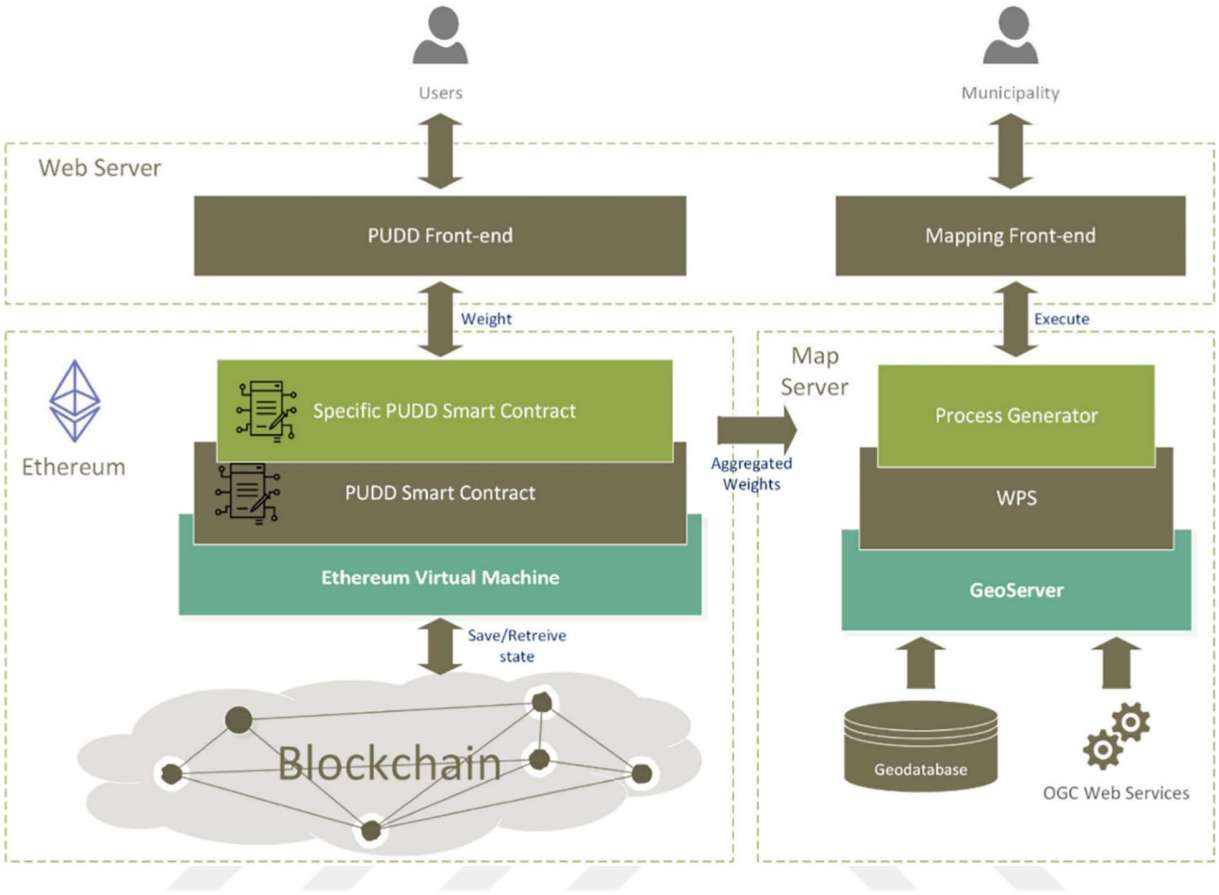


Figure 3.1: The workflow of using PUDD.

Various concepts have been employed to grow PUDD. The system's front-end was established as a web app, powered by JavaScript and React programming languages. To be able to communicate with the blockchain network, the customer side was hired. Drizzle acts as a layer just above software library of Web3.js to allow the user experience to link. On the Ethereum network, the blockchain framework is intended to be applied. Although a local blockchain network, called Ganache, was installed and used for training and test purposes. Moreover, the open-source library was used as the basis of Map-Server. GeoServer has supplied a WPS provider that gets a locked execution script.GIS meta-data utilized for the merging of the different SObj-s as to their contextual relevance. The environmental, economic, government, quality, education and science contexts, the utilities and the natural resources. In all contexts, geographical and demographic characteristics are continuously present. You can select and navigate context. Context. For example, we can proceed to comprehensive analysis (which are also contexts) by choosing the economic condition. We are dealing with media, banking, logistics, insurance, real estate, retail

and geographical and demographic characteristics, which are always defaulting. The economic condition can then move navigation to investigate the immovable context. In the particular context the geographical and demographic attributes are shown, because they are widely and essentially used. Finally, it reaches the context of economic development: it examines its attributes to collect the data and indexes, indicators by filtering data (No more detailed contexts are displayed under economic development).

3.2 GIS SPATIAL OBJECTS MODEL

We view a SObj spatial object as described in [5] as a "recognizable object" situated in a particular location in the world, marked as a single longitude and latitude area. A spatial object SObj= 1... N, which is the overall number of GIS objects, is a map, image of a certain locality, map of an area, a hydrological system of canals / rivers, a building or city cadastral map, for example. SObj is stored in the GIS with its set of { aji } Attributes, i=1 .. m is the number of total of the SObj attributes, and l = 1. L is the sum of the details defined by the GIS at the level l. Therefore, L is a GIS property that is predefined.

The GIS is classified according to different levels of the map. Objects are mapped into several objects (1 to 1 or 1 to many relationships) at the l+1 level in the given layer l of the GIS. For example, at level 1 of the GIS, an object called "Lombardy Region" is transposed into 11 objects at level 2. These objects are of "Lombard Province" (e.g. Province of Milan) are redrawn to one of the province's capital capitals (e.g. City of Milan) and to the province's main cities (e.g. Magenta, Pioltelo, Sexto, etc.).

An object has a number of amalgamated features in each layer. Conditions, such as domains of interest, occur as clustering. Features such as the location, size, owner, and other geo-specific characteristics of the object (latitude, co-ordinates, etc.) are geo-reference. Other SObj attributes define the object characteristics from various points of view, namely Context. Attributes from the first layer are also mapped into the L+I layer in accordance with the tier of the object concerned. Features are also 1 to 1 or 1 to many mappings in GIS levels. For example, the Lombardy Region's attribute of population number will be a provincial population number as well as a next one of the towns (skema-level1-to-1 mapping). The attribute values will be 11 (similar to the number for Lombard province) in the mappings regions, and a rule will be drawn up that the sum of the instance values for the number of inhabitants will match the number of residents in the area.

Contexts

Contexts are an in - depth and focused analysis and manipulation mechanism for decision making on GIS elements, e.g. in the running of an area. We therefore consider that we have a GIS condition repository.

A context is described as an amalgam of{ aji}k features where k refers to k-th and k=1.. P refers to P as the sum of conditions defined for the GIS. A context group is relevant to a certain analysis perspective, namely for a certain discourse area. GeoContext and geo reference group attributes are always named for a default context for GIS objects. There are several contexts with an attribute aji. An object such as a map is subject to economic, environmental, green areas, transport, taxation, mobility and health contexts for example.

The user can navigate context. Contexts. More precisely, you can select a context and then expand to see what its specifics are, i.e. which objects in the context and which subcontexts for these contexts are defined. Contexts can be nestled and monitored by means of a recursive function. This is a navigational hyperlink of conditions until the necessary condition is attained and the underlying data is verified, as it does for Economic Development.

We can solve requests like Q1 by grouping attributes in contexts: "How big is the greenery coverage in this region? "Or Q2:" How many people live in a certain area with one or more kids? ". The selection of SObj objects and one condition k (for example "Green" for Q1 context, and "Urban Quality Life" context for Q2) can be used to analyze the attributes grouped in contexts.

Contexts can be evaluated at different zoom tiers, thanks to the containing characteristics of contexts. This allows for a different inspection of the spatial properties of a SObj by considering first a map of region (the wide area), then the map of provinces in the region and, furthermore, plans of cities and towns in the different provinces, etc. Objects and their attributes clustered and stored in contexts and on various GIS layers can, with respect to user role and permission, be retrieved in different granularity. In the context of the Urban Quality Life, attributes of different levels of granularity can be inspected: from macro features (for example number of green spaces in a urban area) to special attributes (nummer of sports facilities in the district for children).

To summarize, the definition is as follows:

SObj={{geo-attributes}, {attributes}, {(context,level)}, level}

Where {geo - attributes} comprises owners, geo – references, {attributes} is the collection of all features of SObj, the list of pairs is: condition, and the level of information available for which SObj is interested; Level is the tier of the amount of granularity degree in the repository of SObj. A relation {{aji}k} can thus be described to represent the aji features of SObj as amalgamated in the k-th context (with k fitting into the index of contexts for SObj}. This is a many to many relationships.

Examples

1. A region map with geosupport co - ordinates, attributes, contexts and level can be defined as SObj as demonstrated below.

Region Map={Owner, Geo reference coordinates, extension}, {population density, schools, net income, rivers, average income, monuments, transportation means}, {(Economic, 3), (Environment Quality, Education}, 4}.

The economic, environmental and education contexts for the region map are here. Level= 4 means that the region map is shown in 4 detail levels of the GIS: province, town, municipality, area. The economic context with three levels of detail where 3 tiers are traversed to reach the context data.

The { { adji}k } relationship is as outlined: { adji } is a collection of attributes, k is an indication of the number. There are one or many attributes for each k - th context, and this set of attributes may also be associated with different contexts. There are many relationships.

2. A university may be an object of GIS situated in a particular section of a city, has 3 analytical conditions and three details. The following is formalized.

University={Geo reference coordinates, extension}, { taxation level, buildings, facilities, number of faculties, students}, { (Education,2), (Research,2), (Spin-off, 3)}, 3}

For example, if we consider that a potential student (user) wants to evaluate the research conditions of a university, he or she must describe the {{}{{{ aji}} link to outline the attributes of that university. Input the context name, for example. Research, the attributes of this context are returned. The program then travels vertically through the two levels and has access to the' General Scientist Research' (first level) and then to the' Scientific Research in departments' (second level), where measures of the study performance are available in departments (effect factors, number of awards, etc.). It can analyze and decide based on this information, such as PhD applications, grants and science research departments, etc.

Different users can access different information as regards their roles distributed by authorization such as prospective students, existing students, teachers, managers, and chairperson. Users can evaluate certain elements and make them effective and reliable in making decisions based on retrieved information.

3.3 GIS SECURITY MODEL

We have introduced a safety model based on Nhibernate to deal with GIS security problems. Users must be distributed with roles and permissions to access GIS information, with the corresponding SObj-s. when accessing GIS information. Users are allowed by their responsibilities in which users are not candidly linked to permissions, but by roles.

For example, we suppose we have smartphone-based mobile users. Users move through spatial objects through spatial areas physically. Identified their movements via the GPS to progressively render the GIS a map corresponding to the zone they travel.

This thesis extends the security model to a scale that defines purposes of roles in the analysis of contexts in the Nhiberate models suggested in [2]. For instance, if the user is the mobile user (U), the degree of U-R will vary according to the regions he enters and degrees of mobility when he or she moves around an area (i.e. Polimi-leonardo campus) with a green manager (R) role. When U-R entering the area of Building 20, for example, U-R will get' Building 20' and will lose this level if it leaves Building 20. We model users in roles with dimensions in this thesis.

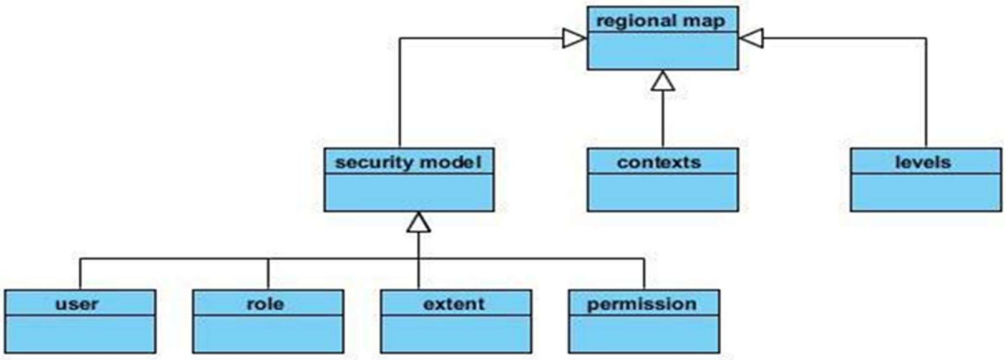


Figure 3.2: GIS class chart for regional map element.

3.4 GIS CLASS DIAGRAM

In the case of security, the diagram shows the security model and contexts as well as the standard of user, role, extent and allowance for the security model. The regional map consists of a spatial object that contains attributes containing several attributes which are clustered in conditions. The following features are stored in the class diagram. Users can retrieve the object on distinct levels of detail in order to obtain more detailed information: the degree at which the object is saved. By filtering and choosing in authenticated spatial object with conditions to access a more specific condition, users can analyze features aligned with the subject, analyze and decide users acquire privileges on the Objective based on their responsibilities and permissions. And the extent to which a role can be activated with permission shows the relevant activities.

GIS Security Model

Users should be allowed to perform roles and access control authorisations to enhance GIS security and to preserve the sensitivity and confidentiality of SObj's data. User privileges with regards to their roles, and then GIS services (such as write, zoom-in, view / read, delete, modify) are provided according to role-based access control. Roles and permissions are stored within a RPB, extricated from this repository and accorded to users by responsibility and permission generator when users retrieve GIS SObj-s.

Table 3.1: GIS security architecture

Role	Extent	Permission
Public user	Information search	View
Green manager	Context analysis	Zoom in/out
		View
Object owner	Data management	Modify/update
		Write
		Zoom in/out
		View
Governor	Decision making	Modify/update
		Write
		Zoom in/out
		View
System manager	System maintenance	Create/delete
		Modify/update
		Write
		Zoom in/out
		View

Table 1 shows the GIS safety design as set up for Nhibernate - based SObj. Responsibilities are amalgamated in a hierarchy where higher responsibilities subsume subroles owned authorizations (roles are increasing from first row to final row in Table 3.1.).

Roles are default and distributed by various users when accessed. In one interaction with the system, roles are unique. The SObj-s Information is only available to public users. Two roles are distributed to green managers: search for information and analysis of context. We assume that each

role requires a specific password. In addition to viewing information when you want to get SObj's for context analysis, you can zoom in or out for finer data visualization by entering a password to analyze the retrieved information. Likewise, a person can access a system manager using three roles, each with the respective permissions, if the user is recognized as system manager. Different passwords make it possible under one role to connect to the system. A system manager, for instance, can only see information with the search function. However, if the GIS system is to remain, it must take on the maintenance function of the system and use permission such as removal, modification / update, view / read, writing, and zoom in or off.

The Green Manager has two prospective responsibilities: search for information and evaluation of condition. The same set of permissions implies a given role. For example, the zoom-in and view / read permission is given for Context Analysis. The system manager uses the framework maintenance functions that provide it a wide range of maintenance permissions: zoom in / out, view, change, write, and create / remove SObj-s. No permission is given to create or delete objects to the user of the object owner. Users, such as the object owner and the governor, may obtain the same permission given their roles: they also have the same permission for other reasons in table 1. Table1. For instance, both the governor and the object owner are authorized to view, zoom in and out.

Figure 3.3 shows a hierarchical approach to the GIS Security model. The hierarchy can be understood in various roles with different permissions from the figure. The public is the least permitted, so that only the particular information given to them can be accessed, viewed and, for green managers, have all public authorizations and the permission to zoom in / out, which are not allowed to be accessed by the public. The system managers with the function of system maintainers have higher permission in this hierarchy to view, modify / update, zoom in, create / delete and write the data. The safety of GIS information is guaranteed with this hierarchy as access to information is strictly controlled through the allocation of corresponding roles and permissions. The following is shown in this hierarchical safety model:

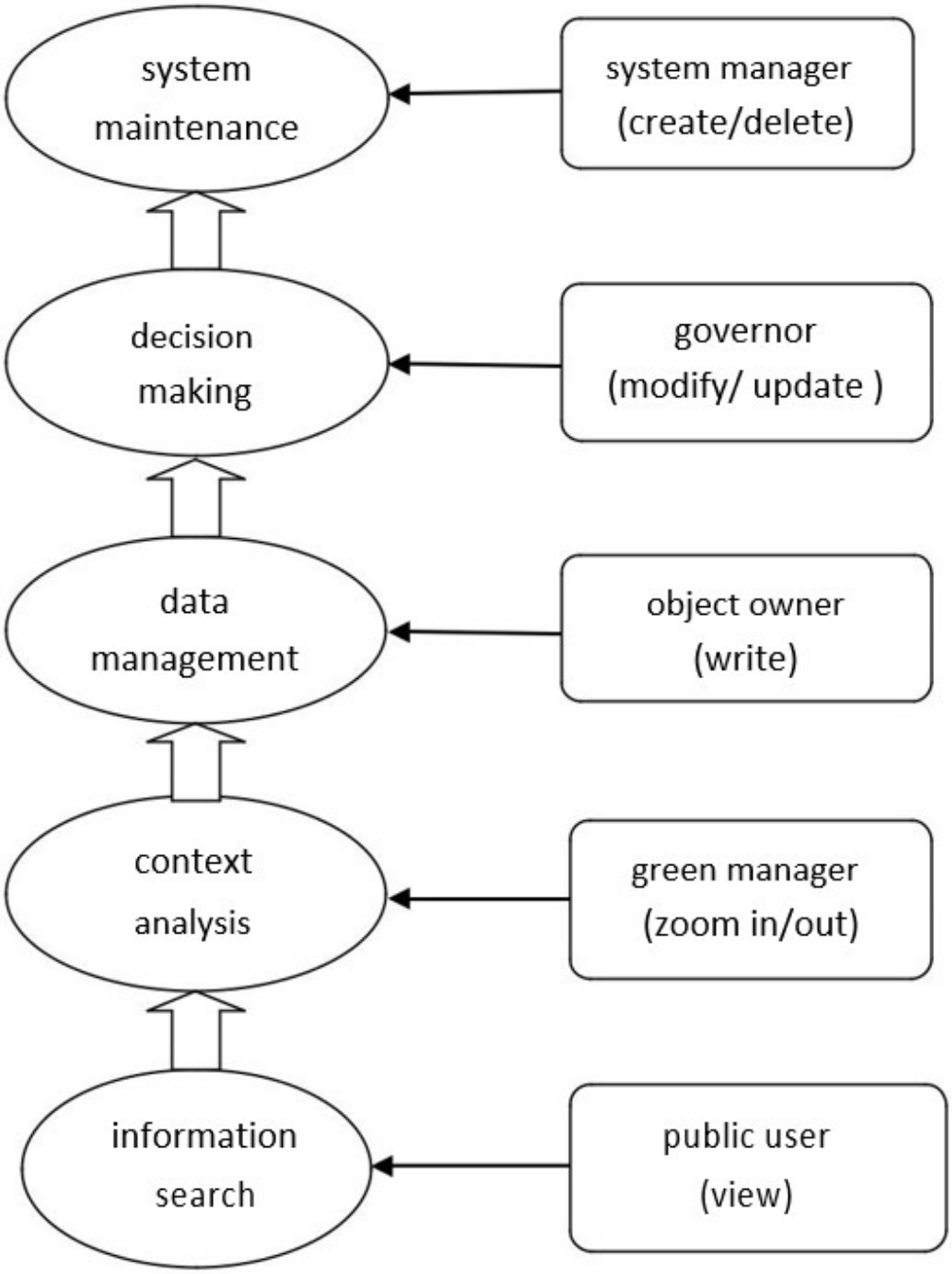


Figure 3.3: GIS security model with hierarchy of roles.

3.5 THE ANALYSIS DIAGRAM FOR GIS

Figure 3.4 shows how users access the required GIS information in their GIS analysis diagram. Generally, an authorizations issuer can control the user's login and acquisition of permission, the role and the authorization distribution. A user can access all available information once the role and permission is obtained. And then a user can utilize a filtered feature to obtain additional information in a given area for a given object. For the same purpose, the GIS analysis diagram may be prepared for issuers of authorizations, individuals or agencies, and GIS managers.

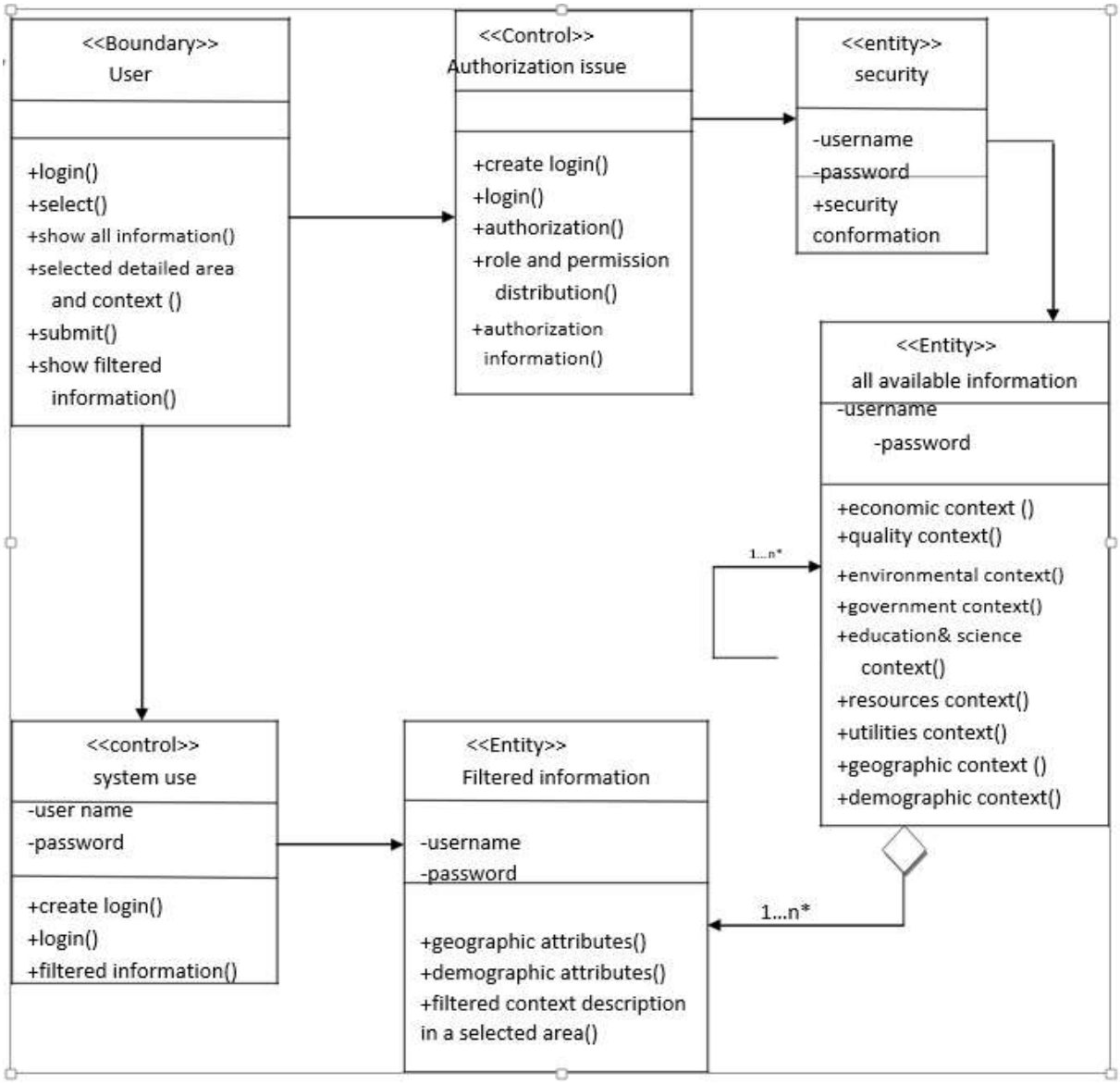


Figure 3.4: The GIS analysis chart for users [Boundary-Control-Entity Model].

3.6 SEQUENCE DIAGRAM OF GIS

During this period, GIS series graphs are produced to indicate GIS data recovery and storage particularly for GIS users, GIS information suppliers (organizations or person), licensing agents and GIS managers who are capable of reflecting a security problem in the GIS and possible threat of GIS security.

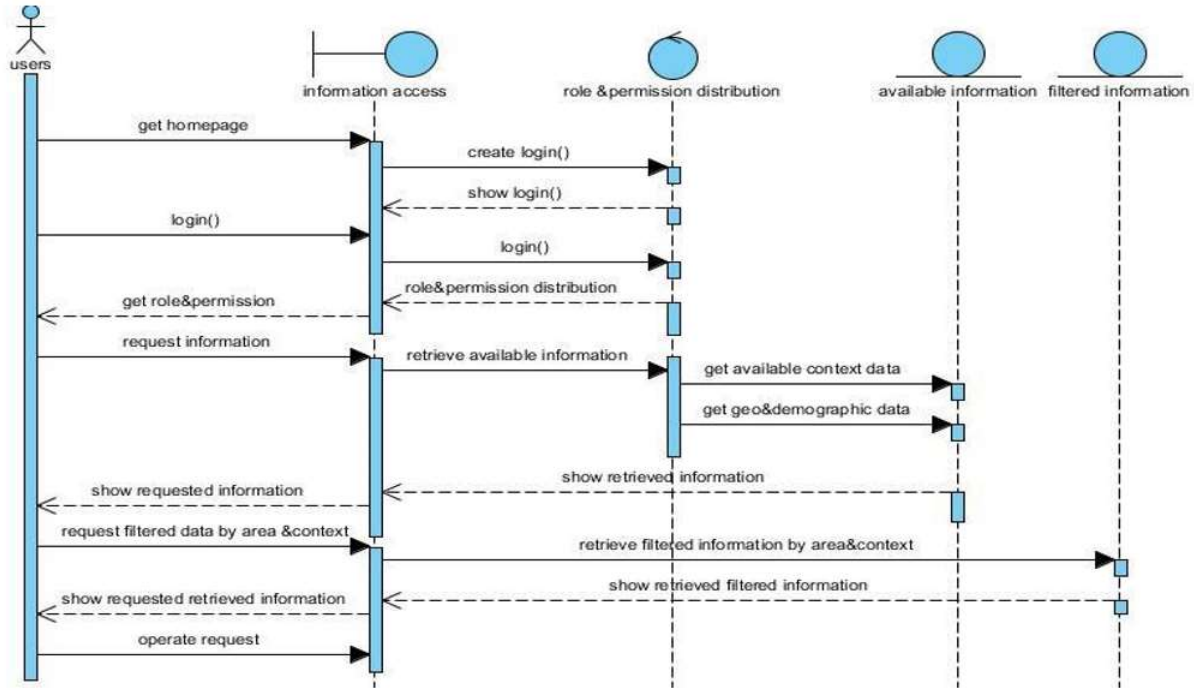


Figure 3.5: The general view on mapping.

The users can retrieve the required data by means of the process outlined as the chart shown, as in the above sequence diagram (Figure 3.5). These activities should all take place in time, such as login, responsibility and permission, collect the information present, select a comprehensive context, and obtain a pertinent description of context analysis.

It should be noted that if there is a conflict between role and permission a priority should be given.

3.7 GIS SECURITY CONFIGURATION

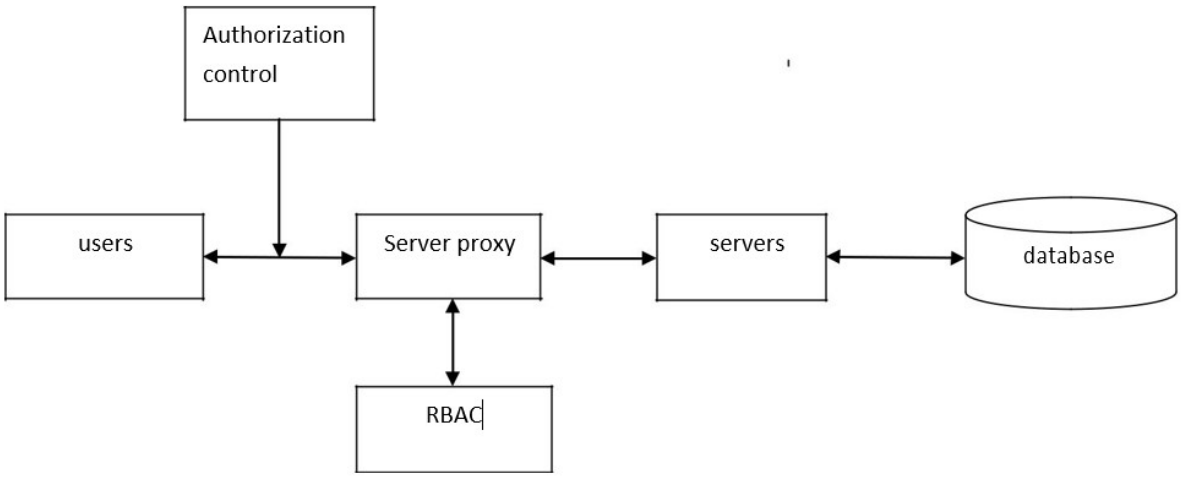


Figure 3.6: GIS security configuration.

As Figure 3.6 shows GIS security configuration, this setup includes users, server proxies, and objects to control authorisation. The control over authorisation is mainly responsible for the distribution of users ' roles and permissions. This gives users a special role when requesting information that allows users to access information for certain objects. Service proximity is correspondence between servers and users, requests from users and feedback from servers can only be made via the server proxy. Further, server proxies can manage user access as regards their roles and authorize users to cipher, or decipher, information that is transferred between servers and users (context to be reached).

The server proxy can generally assign role-reliant access controls (nibernate) and cipher / discipline transferred information that guarantees and enhance GIS security. Users are generally allowed to distribute permissions.

3.8 USE OF AUTHORIZATION MODEL FOR CONTEXT ANALYSIS

The above authentication 0model is presented in this section to show the process of collection of the GIS information and security problems, and how these security problems can be resolve.

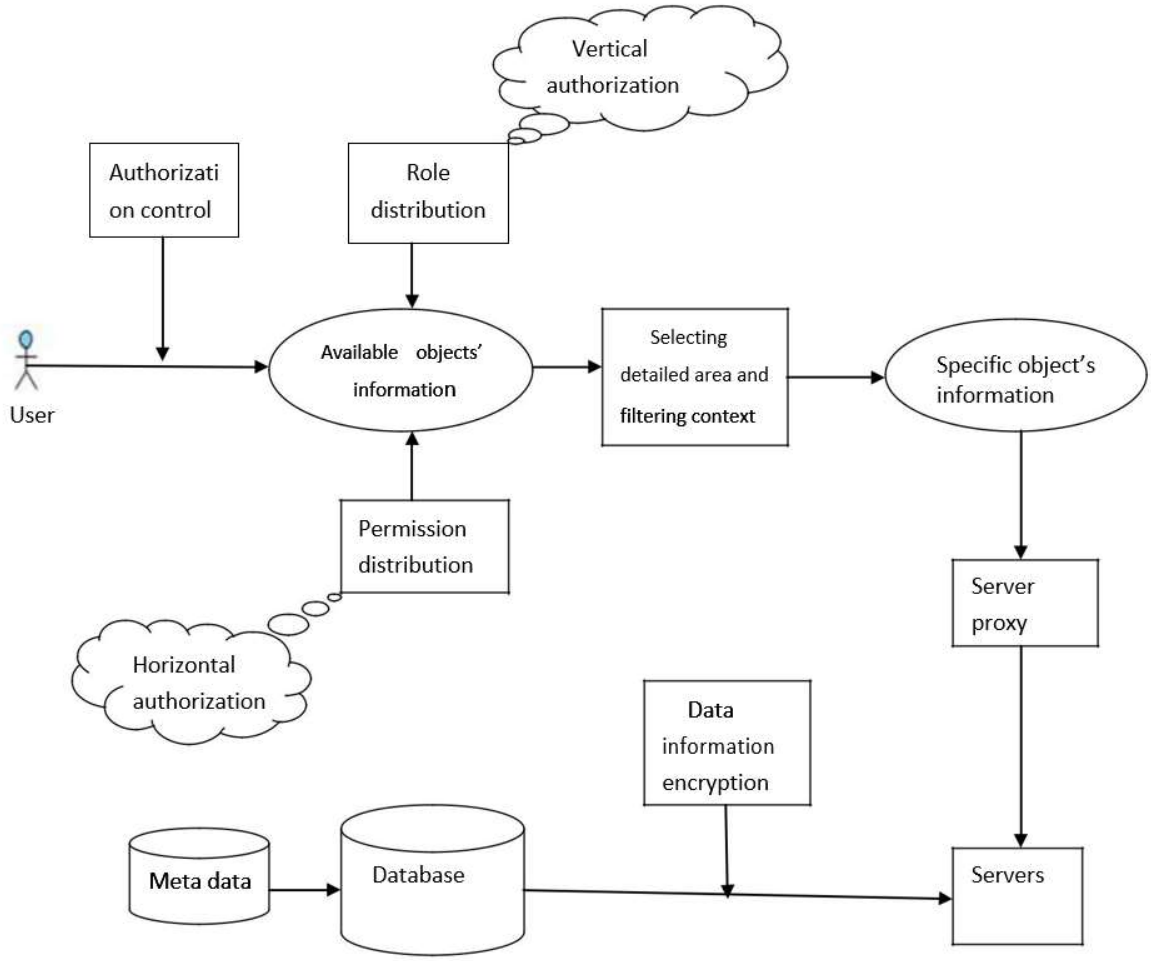


Figure 3.7: Authentication design based on condition analysis in GIS.

We can see from the figure that users want to obtain in the form of context clustering information stored in a database. Firstly, all the information present with regards to role and authorization by the authentication entity to be verified and validated should be authorized for users to access. However, the displaying information may not be complicated for the user. A green manager, for example, needs to determine how much should be invested in improving greenery handling by 30 %. In this case, he can only comprehend all the greenery of the region, including roads with trees, mountains, forests, parks and change in greenery. But once you enter the information interface, all information about your role and your permission is available to you. This is onerous because certain data is not helpful in decision making, but has to be handled in an efficient and effective manner, including the economic situation, wells, governments and so on. In this case, we offer a

framework in which users can choose or filter background data further, thus hiding the unhelpful information from users for accessing green information in a selected field, which helps to analyze and decide more effectively. Users have access to the information interface after selected areas and the filtered context to obtain more data based on this information and interface, can zoom in, vertically and horizontally zoom in with a difference in size and proceed to select and filter if relevant. As demonstrated in the figure, user requests may be transferred to servers that retrieve related data from a database where data is encrypt to secure information through a server proxy. Users need a role and permission to access information. Rolla blazing allows users to obtain granularity in information for vertical authentication in the various pecking orders, permit users to retrieve context authorization details in the same level.

3.9 NHIBERNATEMAPPER ARCHITECTURE

The process of NHibernateMapper file creation is based on current relationship databases and specific domain knowledge in applications. Classes are available for application programming. The tool uses open NHibernate scheme definitions-mapping the mapping file name (nhibernate-mapping.xsd). For the use of the NHibernate Mapper tool that is the existing and the domain object, the Dynamic Linked Library (DLL) classes shall be applied. NHibernateMapper is automatically extracted from the database and the Member Class attributes for the DLL selected.

The user must select an object manually-a class-oriented object and a data table. The schema and attribute of the database is then automatically scanned and suggestions for the user mapping are shown. For each column, the applicant mapping is made based on a matching string algorithm (column–to-map) and on a data-type comparison. The user may reject or accept the proposed mail. Upon completion of mapping suggestions, users may also use an interactive GUI. In addition to the acceptance or refusal of the proposed mapping, mapping can also be manually redefined. Users can be saved in the NHibernate XML mapping file when the mapping definition has finally been met.

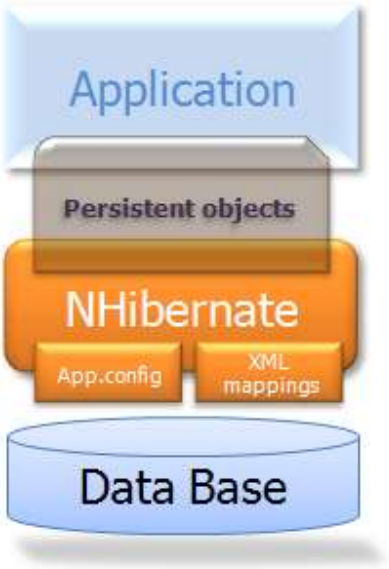


Figure 3.8: Nhibernate Architecture.

4. IMPLEMENTATION AND RESULTS

The software system was developed using C# language and MVC (Model View Controller) supported with Entity Framework and NHibernate Mapping. A connection to the SQL-Server is done using the SQL Server 2012 and Nhibernate injection as illustrate in Figure 4.2.

```
private static ISessionFactory CreateNhSessionFactory()//(Assembly _assembly)
{
    var connStr = DBHelper.getDB_CNN(); // ConfigurationManager.ConnectionStrings["DB_CNN"].ConnectionString;
    try
    {
        return Fluently.Configure()
            .Database(MsSqlConfiguration.MsSql2008.ConnectionString(connStr))
            .Mappings(m => m.FluentMappings.AddFromAssembly(Assembly.GetAssembly(typeof(ENTUserAccountMap)))

                .Conventions.AddFromAssemblyOf<PriamryKeyConvention>()

            )
            .BuildSessionFactory();
    }
    catch (FluentConfigurationException e)
    {
        throw new Exception("Connection Error:" + e.Message, e.InnerException);
    }
}
```

Figure 4.1: The connection function in the Dependency Layer.

The tables of the database structure is as seen in Figure 4.1. The proposed system interacts with each table and form individually. Each table is called individually to create a separate page for each activity such as view, add, delete, edit.

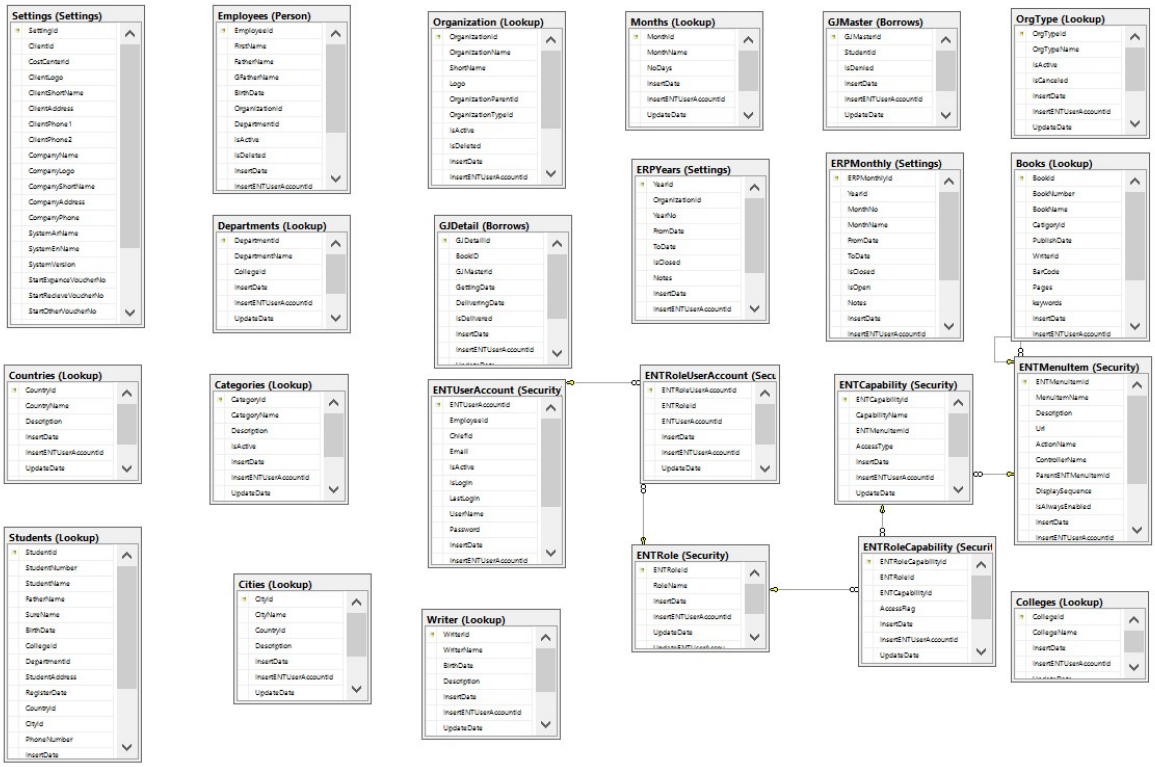
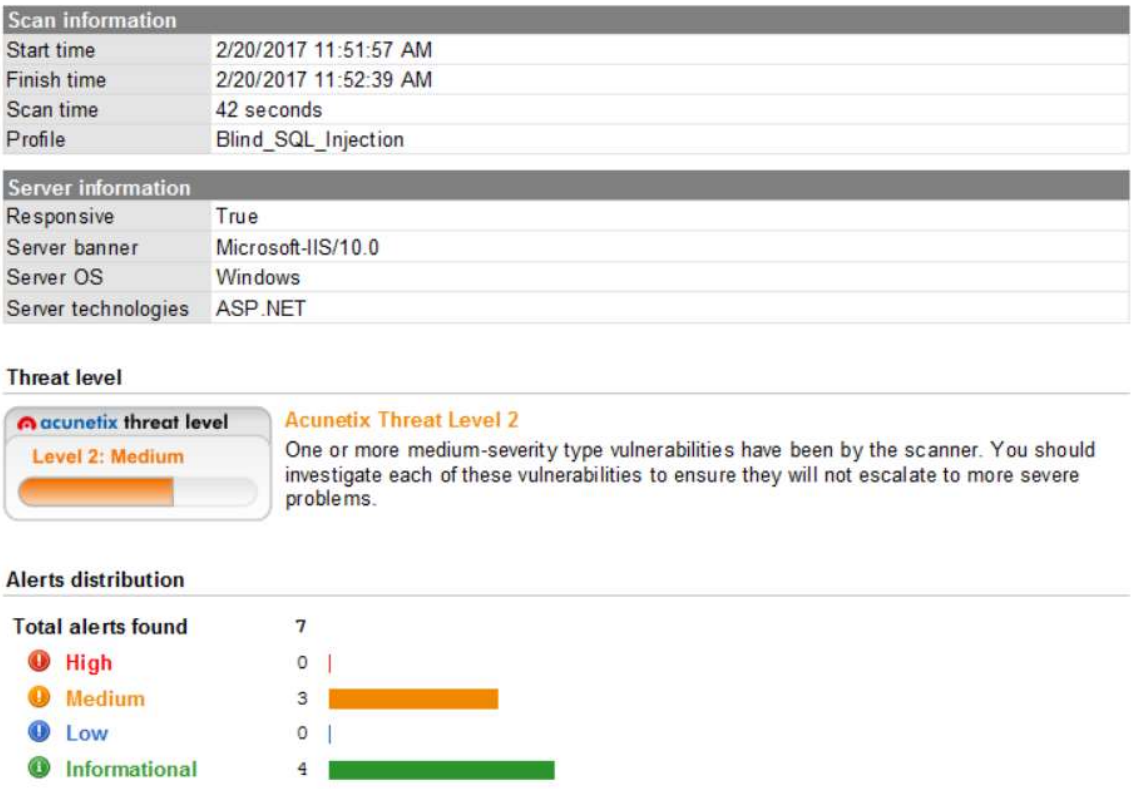


Figure 4.2: The system's general database structure.

Each page simply interacts with a single table by opening a connection to the SQL-Server and then to the selected integrated database and therefore to the specific table in the database. The GUI applied is a friendly and easy to use web interface but with database related functions. So the user will experience a special database engine using normal internet browser without the need to special software like a database viewer.



Scan information	
Start time	2/20/2017 11:51:57 AM
Finish time	2/20/2017 11:52:39 AM
Scan time	42 seconds
Profile	Blind_SQL_Injection

Server information	
Responsive	True
Server banner	Microsoft-IIS/10.0
Server OS	Windows
Server technologies	ASP.NET

Figure 4.3: Acunetix report about system's security.

The reason of being in the medium level is due to the use of Nhibernate injection reliance which is software modeling pattern that permits elimination of hard-coded dependencies and making it easy to alter them, whether at compile-time or run-time in additional term it uses injection techniques to insert or get data to or from database. The Nhibernate injection dependency is used to separate the generation of client's dependencies based on the client's characteristics which permits program models to be loosely coupled (Loosely coupled systems are systems that their components has, or makes use of, little or no knowledge of the definitions of other separate components).

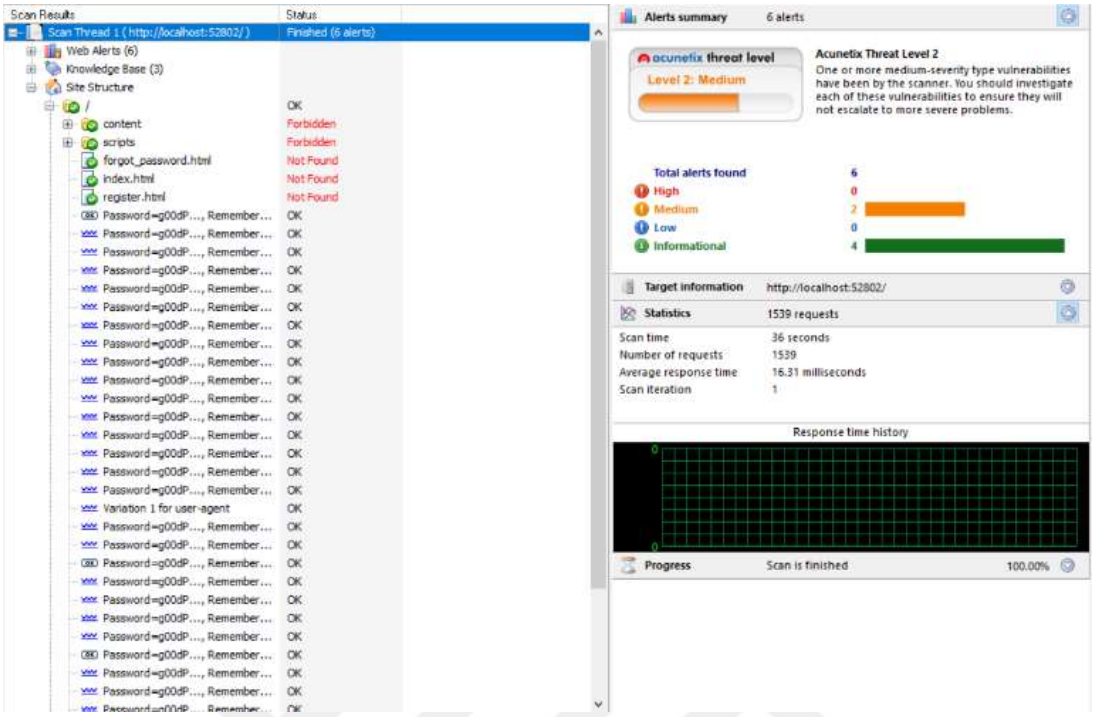


Figure 4.4: Acunetix's security for the system.

5. CONCLUSION

The use of the 3 tier architecture has gave some advantages to the solution in term of security such as making the data management independent from the physical storage (SQL Server), faster migration to new graphical environments, higher possibilities for making changes to the presentation level without interrupting the other layers, higher possibilities to use different kind of development functions and techniques, the business is highly secure since the clients don't any kind of access to the database and the probability of losing data is very low and close to 0% due to the layers blocking to the user.

Meanwhile the disadvantages of the 3 tier architecture is consisted on the complexity of the structure, setting up the 3 tier architecture system and maintaining it is more than the regular systems, in the older versions of the 3 tier architecture techniques the physical separation between layers affected the performance and this particular one has been solved using additional techniques such as Entity framework, Nhibernate, SQL Stored procedures, JavaScript etc, these additional techniques not just improved the performance only it even boosted its security from hacks and SQL injections. Even with the difficulty of the 3 tier architecture development, it provides the best ways for the professional software developer and professional programmer to get faster and better solutions for developing an application system, solving SQL problems and using as less mounts of codes as possible. After using an application called Acunetix WVS 9 (Acunetix is a Vulnerability scanner that used to discover hackable and weak points in a software or a network) the security results went to be medium level against blind SQL injection and SQL injection as.

NHibernateMapper is a set of scheme mapping tools. This tool was specifically developed for mapping data to dominant model classes via existing databases. Domain classes can be used as a starting point in Ontology. For an authentic object, the mapping specifications for a semicolon were also developed based on the NHibernate ORM. Ontologies provide a consistent mechanism for defining the importance of data and are a suitable way of defining a domain model. The ontology concept can be regarded as a domain object, as represented on the maps of existing relationship databases by ontology as an object. NHibernateMapper is mainly generated for uses

the area of geographical information systems. It can be combined with a tool that change ontology into an object-a class orientated concept. Therefore, NHibernateMapper should be able to support the creation of access data layer applying existing ORM tools. The use for intraoperative GIS solutions of semi-Automatic mapping and the [4] tool can play a large part in developing data access layers quickly.

A sophisticated new DBMS is provided by the configurable NHibernateMapper design. At present only hibernate mapping is supported by NHibernateMapper. The enhancement plan presupposes the addition to other popular ORM map definitions of the Microsoft Entity Framework. The tool is also meant to be included in the entire WebGIS application source code generator solution.

5.1 SUGGESTIONS

In this study, we evaluate the ANN on EEG signal dataset applying the collected datasets. For future proposals there is need to consider the below points:
The present analysis took into consideration the single class issue for classification, nonetheless, for the real-time conditions this won't always be the instance. So we propose analyzing the functioning of the design using multi-class datasets.

Secondly, the deliberation of real time data and might an interesting future direction in this field of study.

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