

**Paper ID: 2012278**

# **Exploration Information Management System: An Approach to Manage Core Information Related to Hydrocarbon Exploration Ensuring Maximum Availability for Easy References**

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## **Abstract**

In this paper, an approach has been discussed regarding how to manage Core Information Related to Hydrocarbon Exploration Ensuring Maximum Availability for Easy References. In this study, different aspect of software development, cost analysis and features to integrate such system are considered and a prototype is developed to check the functionality. The layout of the system design and the background database has been made with meticulous care to ensure maximum scalability allowing seamless integration of new data and data types without need for a major changeover. The database is normalized to the highest degree, so that future alterations to the database does not require wholesale changeover of keys, relationships and database schema. Exploration data management system thus plays a critical role combining technology with business to get people the information they need to do their jobs better/faster/smarter.

## **Introduction**

The energy industry doesn't just explore for and produce oil and natural gas. The industry also actively explores information technology to increase exploration success and to reduce production costs (Yogi Schulz). Thus, IT plays an important role in encouraging exploration. One of the major roles of IT in exploration industry is perhaps the management of exploration data which is both expensive and important. A database consisting of only hard copies requires more time to consolidate and scattered data can have huge time implication. Thus a strong data base management system is top priority for smooth and quick functioning of the exploration job.

Storage of data, management of databases, retrieval of data, and transmission and manipulation of data are the various uses of a data base management system that plays a decisive impact on the development of the industry. A database management system enables the businesses and enterprises to store and retrieve large volume of data instantaneously which directly have a time implication. Also it helps in presenting an organised data which then becomes information. Thus by having access to critical information at our finger-tips, decision making becomes easy and quick. And all this is achieved with fewer people.

In the competitive exploration scenario, time has become an important factor and thus managing both geo-scientific data and other techno-administrative related data under one roof has become essential.

Now, it is a billion dollar question that whether we should license a pre-packaged or off-the-shelf business software solution that will meet 70 -80percent of our needs or would it be decent to build and design a custom software program which can be used either by a specific function or cross-functionally across the organization. And while choosing between these two, we must evaluate our options, not bank on assumptions and make well informed conclusions. This is because the software tools we employ to expedite our work, will soon mould our work behaviours around them. Sooner than later, the software tool will become a part of our regular job. When the tool falls short in certain areas, the software developer will (have to) come up with workarounds to continue using the software tool as there are costs involved with either of the decisions - to build or buy.

There is no doubt that building a custom software program in-house saves a lot of money when compared to purchasing the tool externally. But the particular internal group who are responsible to be building the software must have skills / time / money / resources that matches all requirements and can maintain the same on an on-going basis.

## Objective

Exploration Information Management System is an “intellectual property” designed to serve as an extensive data manager of an enterprise by storing, retrieving, managing, manipulating and accessing the data related to exploration work in a quick and easy way for better performance and decision-making. The important requirements that were considered during the development are:

- A. Storing a large number of records
- B. Ease of use when accessing information
- C. Ease of storage
- D. Multiple user accessing at same time
- E. Easy way to add new data and to edit or delete old data
- F. Data security
- G. Easy import/export functionality

## Exploration Information Management System (EIMS)

Most valuable information to an interpreter/manager in exploration world has become virtually unmanaged and ungoverned due to lack of good data management system. Exploration information management is a system that manages exploration data such as geological data, geophysical data, well data, NELP related data and administrative data and allows fast storage and retrieval of that data providing clean, consistent data at a minimum time. The proto-type has been developed using a wide range of data related to exploration job. However, provision is there for future expansion. Fig.1 illustrates the various headers which were created for storing data in the system.

In this prototype, Broad headers are created which are Home, Well data, Well reports, Well Logs, G&G Reports, Lithology plot and user profile (Fig.1). Well reports like Drilling Reports, Daily Drilling Report, Location Release order, Executive Drilling Program, Rig Release order, Gas Analysis Report, Testing Report, Well Cost report; Well Related Data like Casing, Well Chronology, Well Header, Lithology, HC Shows, Logs Recorded, Side Wall core Header, Mud parameters etc; Well Logs like Wireline Log, Master Log, Gas Ratio Log, Composite Log, Pressure Log, Drilling Log, Elan Processed Log, MDT Log, FMI Log etc; G&G Reports like Source Rock Study, Biostratigraphy, Seismic Interpretation, SBL Report, Conventional Core, SWC report, Sedimentological Report are the different heads under which data can be stored. Import authorisations for loading the parameters are given to authorised users only. Data can be viewed and exported in PDF or Excel format and an advance search option is incorporated for faster data finding. An option of lithology plotting is developed in which percentage lithology of a well can be displayed. No license is required for accessing the database and data can be viewed from any Desktop PC/Laptop using web browser like as internet explorer, and Google chrome within company's intranet making it possible to view all data in a single window. The database supports multiple users at any given point of time. Viewing and downloading the data from database is on the basis of proper authorization and there is a provision for hierarchy/ part based authorization.

## Salient Features of EIMS

### a) Hierarchical Authentication System

Hierarchical Authentication System shall implement data encapsulation/security by protecting it from unauthorized access and device an authentication system where users shall be granted access to the available information depending on the access rights to the user. Functional requirement for such system must include capability for validating access privileges against the required access permissions before giving access to the requested data to the user.

### b) Robust Database

We required a data storing software which can manage concurrent access to the data, indexing of data for faster searches and supports user authentications. Out of all the available options, we chose Microsoft SQL Server for developing the prototype as it meets all the under mention features.

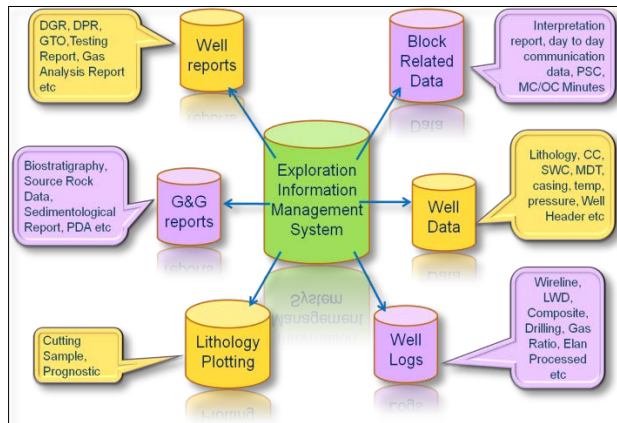


Fig.1: Schematic diagram showing the different headers in EIMS

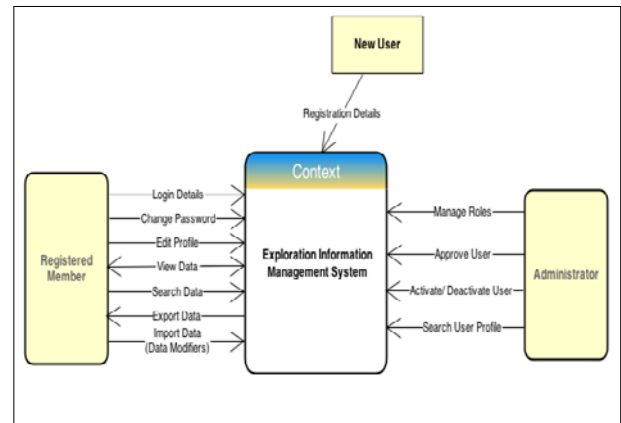


Fig.2: A role based hierarchical System

**A. High performance and scalability**

SQL Server provides support for very large databases, up to one terabyte. SQL Server works very efficiently on Microsoft Windows Servers by processing queries in parallel and minimizing additional memory requirements when more users are added.

**B. Increased availability**

MS SQL Server Database can be backed up, either incremental or complete, while the database is in use. This means it confirms high availability.

**C. Improved security**

Information stored in database tables can be accessed through proper authorisation.

**D. Immediate recoverability**

In case of system failure, database Server automatically recovers database to the last state of consistency in a matter of minutes.

**E. Reliable distributed data transactions**

Database Server supports atomic transactions with transaction logging which confirms consistency and recoverability of a database transaction even in the case of system failure and in the middle of complex updates by more than one user.

**F. Server-based processing**

Server supports client/server database. Applications can use stored procedures and triggers, referential integrity code, application logic, queries on the server, rather than on the client.

**c) Ease of Accessibility**

Raw Data or input data prioritisation is an essential entity for software development. It gives a complete idea how to design the application and managing data as well as the storage type. Classifying the data which to be indexed for faster retrieval with effective and efficient way always an important aspect.

**d) Software Language**

There exists lot of available tools and languages but it is really important to choose one possible combination that gives the software the best look, feel, performance and most importantly protection for the threats. For an efficient and effective development along with smooth and clean integration with database as well as considering the flexibility of development for advanced version without compromising the security aspects the following tools are considered for development.

**i) ASP.NET Razor View Engine with C#**

Razor is an ASP.NET programming syntax used to create dynamic web pages with C# or Visual Basic .NET programming languages. ASP.NET Web Pages and the new Razor syntax provide a fast, approachable, and lightweight way to combine server code with HTML to create a dynamic web content. Razor is a simple-syntax view engine and was released as part of ASP.NET MVC 3 and the Microsoft WebMatrix tool set.

**ii) HTML 5**

HTML5 is the latest hypertext mark-up language for websites from the World Wide Web Consortium (W3C) having new and improved features.

**iii) CSS 3**

Cascading Style Sheets (CSS) is used to control the style and layout of Web pages. CSS3 is the latest standard for CSS.

**e) Overview of the EIMS**

We proposed a systematic software development model to support the management requirements. The processes which can meet the requirement to build more effective and systematically managed modeling consist of steps, each of which is composed of detailed activities. Such approach will add more flexibility of development for advanced version and error debugging. An illustration is given below for reference.

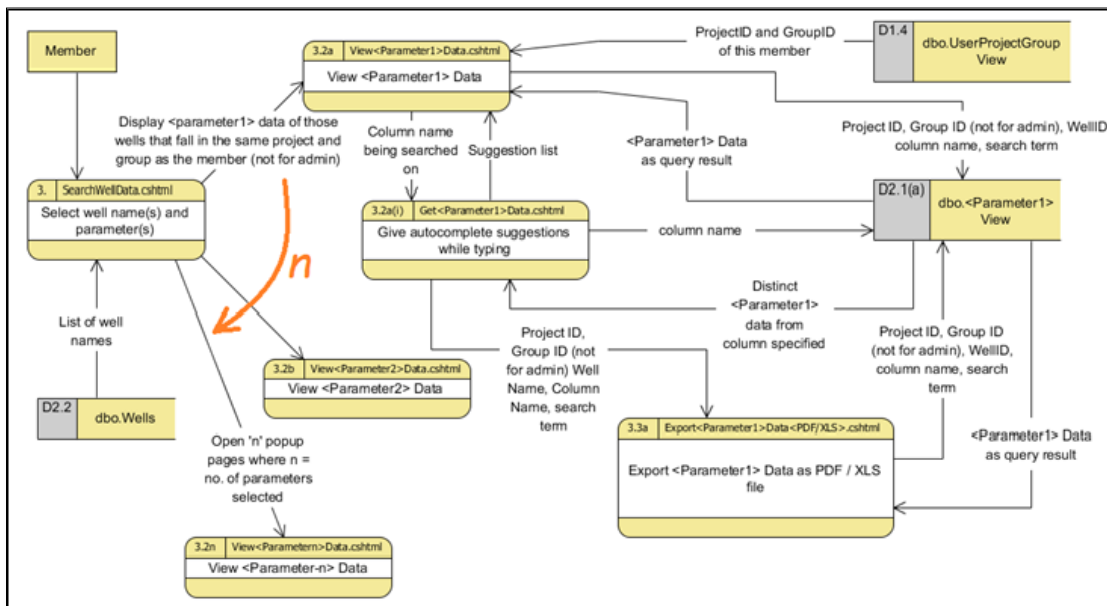


Fig. 3: Schematic showing Search, View and Export Well Data

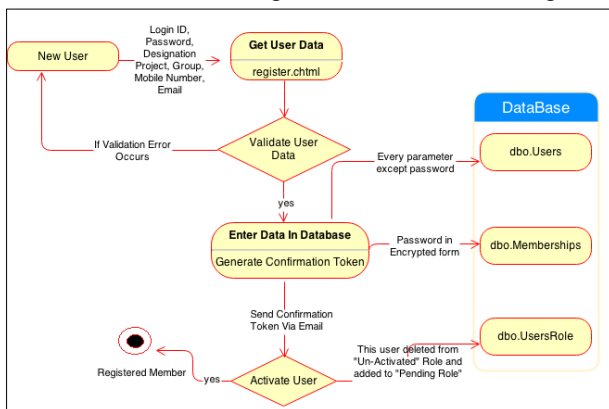


Fig. 4: Schematic showing Registration Process

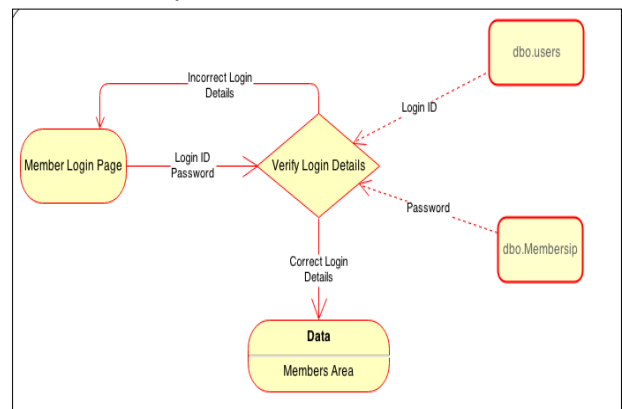


Fig. 5: Schematic showing Login Process

## f) Glimpses of EIMS

A few screen-shots are presented in the figures below which will give a general idea about the software.

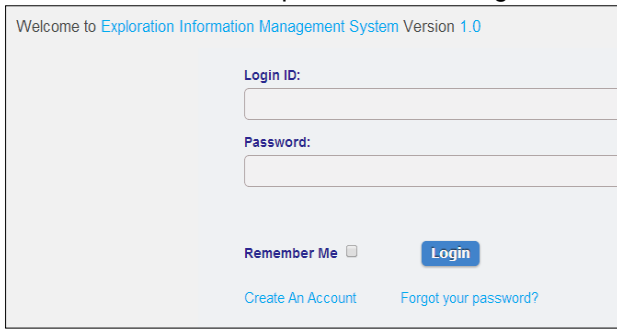


Fig. 6: Schematic showing Login Page

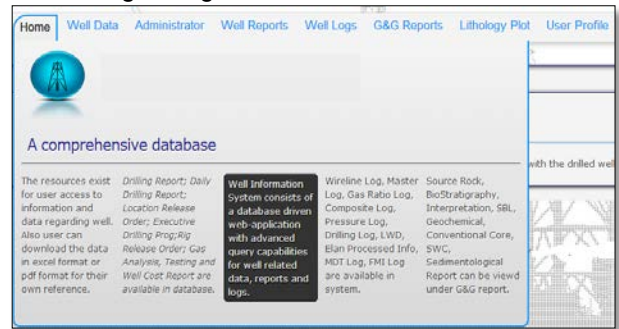


Fig. 7: Schematic showing Web Portal



Fig. 8: Schematic showing Well Reports

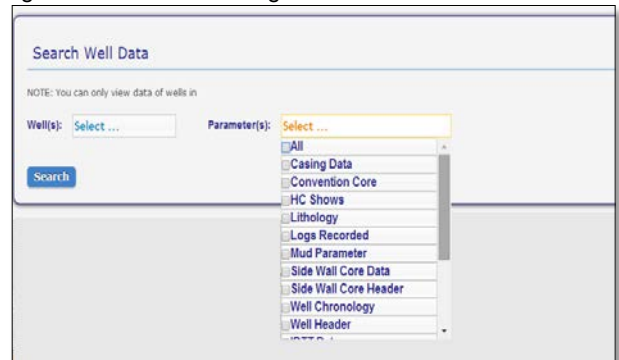


Fig. 9: Schematic showing Well Parameters

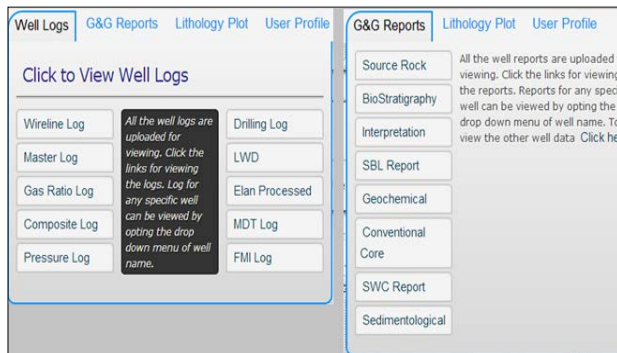


Fig. 10: Schematic showing Well Logs and G&G Reports

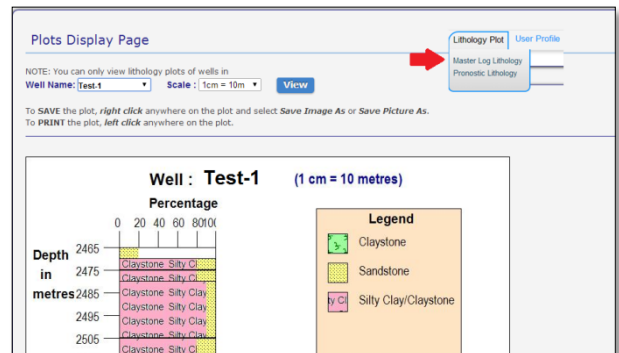


Fig. 11: Schematic showing Lithology Plot

## Cost Estimation

An approximate judgment of the costs for a project throughout the entire life cycle should be carried out before commencing any project to check the cost viability. Once the requirements have been finalized initial cost estimation can be done by setting the inputs to the process and by generating the output. An effective monitoring and control of the software costs is required for the verification and improvement of the accuracy of the estimates. The success of a cost estimate method is not necessarily the accuracy of the initial estimates, but rather the rate at which the estimates converge to the actual cost.

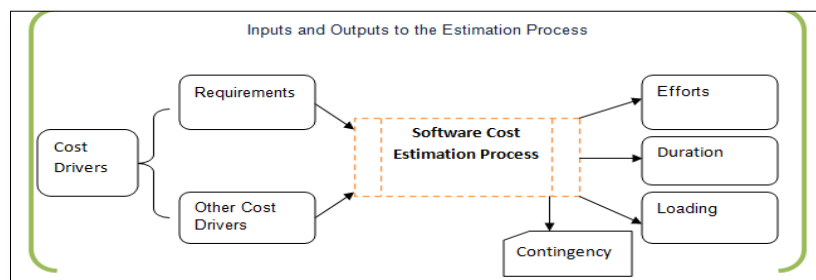


Fig. 11: Schematic showing Cost Estimation

Some important parameters for estimation are noted like as Resources - such as programmer/analyst, Web Developer, etc. training - Add any training costs that will be absorbed directly by the project, all projected travel costs, other non-labor - This could include project team meetings, supplies, phone calls, etc. and Hardware – Software cost.

## **Software testing**

Software testing is performed to verify that the completed software package functions according to the expectations defined by the requirements/specifications. Main objective for such testing is not to identify the bugs rather to find out the aspects that could impact the software usability. Functionality testing, parameter testing and performance testing are the essential aspects before deployments. It is required to estimate the performance of a system in production which will help to make a decision if system is capable of handling day to day activities and future versions in respect of functionalities or operations before making the release. It is also important to determine or measure the acceptable label of stability, capacity, identifying the bottlenecks.

## **Conclusion**

The main purpose of Exploration Information Management System is to manage and preserve the exploration data, which is both expensive and valuable, with security and to provide the right information in minimum time whenever necessary so as to facilitate both day to day work and decision making processes. Being an in-house effort, the system will save the cost of licensing and also overhead cost of AMC and future customization and feature addition will be without any high financial impact. A prototype-web based application considering the ease of accessibility is developed using ASP.NET, C#, Java and MSSQL database in line with the existing exploration industry scenario, but extensive quality checking before implementation is necessary.

## **Acknowledgement**

We are indebted to Shri A. V. Sathe, GGM-Basin Manager, ONGC Ltd. for providing infrastructure and useful guidance and support to carry out this study. It is with feelings of profound thankfulness and deep sense of gratitude that we acknowledge the precious guidance and consistent encouragement rendered to us by Mr. S .K. Das, GM-Block Manager, ONGC Ltd. We are thankful to Shri. B. N. Bhaumik, DGM for his continuous encouragement and time to time monitoring & guidance during the studies. We express our sincere thanks to Shri. A. K. Seth, DGM and Shri. S. K. De, Chief Manager, ONGC Ltd, for providing constant help and guidance. Special thanks are due to Shri. B. Banerjee, CG, ONGC Ltd. for his constructive criticism and encouragement.

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