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Design and Implementation of Security Mechanism for Data Warehouse Performance Enhancement Using Two Tier User Authentication Techniques

Rajdeep Chowdhury [1], Prasenjit Chatterjee [2], Pubali Mitra [3], Olive Roy [4]

Assistant Professor, Department of Computer Application, JIS College of Engineering, Block–A, Phase–III, Kalyani, Nadia, West Bengal, India [1]

Student, Department of Computer Application, JIS College of Engineering, Block–A, Phase–III, Kalyani, Nadia, West Bengal, India [2, 3, 4]

ABSTRACT: Data warehouse is a set of integrated databases deliberated to sustain decision-making and problem solving, embracing highly abridged data. Data warehouse happens to be progressively acknowledged subject for contemporary researchers with respect to contemporary inclination of industry and organizational purview. Data warehouse is one of the imperative contrivances for decision support system. Data warehouse is a repository which contains all the organizations data in entire capacity. Concentration of hacking has been intensifying diurnally; hence the incorporation of security mechanism has become a decisive concern for any organization in shielding the sensitive data.

The compiled paper illustrates that how an undemanding security mechanism could be applied to defend the warehouse from unauthenticated access and malicious intrusions. The formulated paper also expresses the significant purpose of security mechanism deployment, thereby not degrading the performance of the warehouse, that being the consistent interaction time amid the client and the warehouse.

The compiled paper ensures the design and implementation of security mechanism for data warehouse performance enhancement, with the incorporation of the well-knitted two tier user authentication techniques.

KEYWORDS: Data Warehouse, Dimension Table, Fact Table, View, ETL, Two Tier User Authentication.

I. INTRODUCTION

Data warehouse is an entrenched repository of an organization's electronically amassed data [1]. Data warehouse are designed with the intent to facilitate inclusive reporting and adept analysis. Furnishing security for the warehouse is almost an enormous headache for any organization. The proposed work is exceedingly effortless, as it discusses about how a sturdy security mechanism could be employed at different tiers or levels for data warehouse performance enhancement [1, 2, 3].

At the first tier, the client has to opt for his/her user category, like, MD, Director, HR Mgr., and so on. The category assortment endows with an abstract vision of the data; which means that if the chosen category of the user is HR Mgr., then the user would only be able to view the HR Mgr. allied data, other than which it would not be able to view any other data.

At the second tier, an automatic engendered code would be sent to the particular user's mobile, who is presently trying to access the warehouse and when that specified code is furnished by the user from his mobile, then only the user

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would be able to view his/her yearning data. The proposed technique exceedingly ensures that only authenticated user would be accessing the warehouse, thereby curbing malicious intrusions.

The proposed work also ensures that despite the implementation of the two tier/level of security, the performance is absolutely ensured up to the desired level, which means that total transaction time is simply favourable.

The entire proposed work has been ensured through the case study demonstration/illustration of JIS Information Access Portal and all its basic facets.

II. LITERATURE SURVEY

The section primarily focuses on the allied work available in the same genre and if any such work has been a motivating aspect during the formulation of the concerned paper [2, 3, 4, 5, 6, 8, 9, 10, 11, 12].

There are quite a few allied works on data warehouse and its security measures, which have previously been carried out, but the exact design and implementation of security mechanism for performance enhancement using tiers/levels of user authentication is something innovative as well as appealing for modern researchers. Whenever the notion culminates in the mind about design and implementation of security mechanism for data warehouse, the comprehensive study of few papers need special mention and the brief glimpses are stated in concise for ease in reference;

In the paper titled "Towards Data Security in Affordable Data Warehouse," the data warehouse technique is based on clustering and the star schema is dispersed over the nodes of the cluster. Dimension table is replicated in apiece node of the cluster and fact table is distributed using strict round robin or hash partitioning. Security is assured by using signature in each column individually and in each row the verification is controlled by data warehouse middleware. Data warehouse middleware engender the signature for insert and update operations. In the concerned approach, encryption technique is applied on dimension table. Primary keys and foreign keys are not encrypted as they get filled with synthetic values. Encryption technique is not used in fact table due to performance issues. Fact table is fragmented into several clusters and fact data cannot be simply allied to the dimension data as they are encrypted [2].

In the paper titled "Towards the Secure Modeling of OLAP Users Behavior," the proposed model has three parts, namely; Static Model, Dynamic Model and Session Control.
In Static Model, the data warehouse's static aspect is implemented using UML profile and the security aspects use ACA model.
In Dynamic Model, the already sensitive queries that have been specified by using joint rules, have a dynamic model stage in which apiece sensitive query is modelled by using an extension of state models for secure OLAP [7] systems.
In Session Control, the entire session control is restored for reference [3].

In the paper titled "An Integrated Conceptual Model for Temporal Data Warehouse Security," it has been proposed that the first integrated conceptual model for addressing temporal data warehouse security requirements needs specification. The model is the first model which combines ETL model with temporal data warehouse model in one integrated model. ETL processes are accountable for extraction of data from heterogeneous operational data sources, their transformation (conversion, cleaning, normalization, etc.) and their loading into data warehouses.
ETL proposed model has six fragmented steps, namely; 1-Source authentication, 2-Extractraction, 3-Filter process, 4-Incorrect process, 5- Surrogate process and 6-Load process [9].

These are three of many papers which have had an unswerving impact during the formulation of the basic crux in the compiled paper and the very nuances that have conjured up the skeleton of the innovative proposed work.

III. PROPOSED WORK

In this section, the detail of the proposed work has been specified and the two tier user authentication mechanism employed has been discussed comprehensively. The proposed work comprises of two fragments, namely; security

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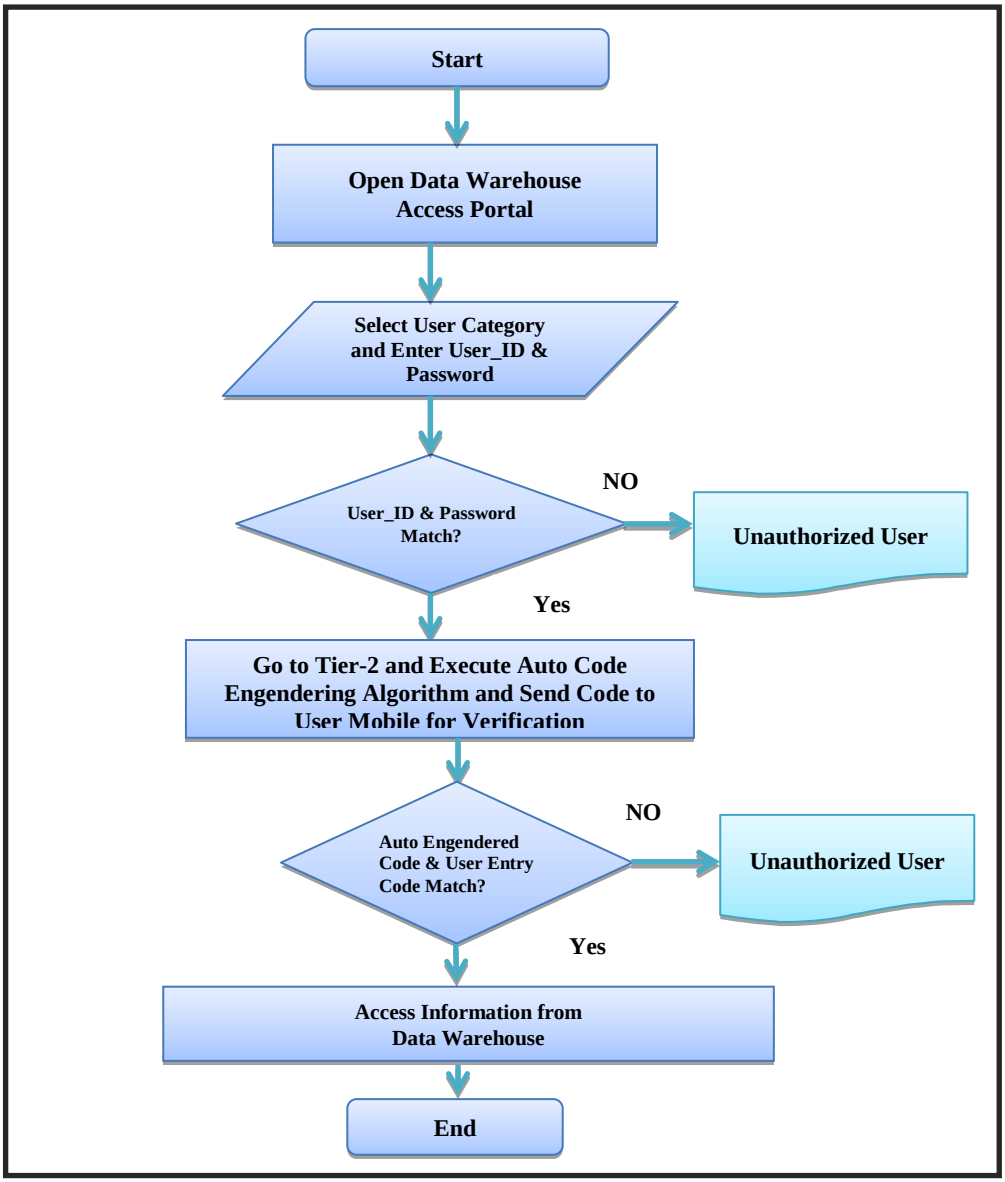
implementation by user authentication at tier one and security implementation by sending an auto engendered code to user's mobile phone at tier two.

For tier one security implementation, initially the user would have to select his/her user category from a set of existing user categories, like, MD, Director, HR Mgr., etc. and then log in using User_ID and Password for switching to next step. At next step or tier two, an automatic code of length six would be engendered by an algorithm devised, and then that code would be sent at user's mobile phone, trying to access the data warehouse.

For utmost ease in understanding, the flow chart of the entire proposed work has been designed below:-



Fig–1: Flow Chart of the Proposed Two Tier User Authentication Technique

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Proposed Algorithm Overview

The proposed algorithm would have code of length six and it would be alphanumeric, out of which three would be alphabets and the other three would be digits.

The first, third and fifth positions would have alphabets placed, and digits would be placed in second, fourth and sixth positions.

Automatic Code Engendering Algorithm

There are twenty six alphabets, and with respect to upper case and lower case, there are fifty two alphabets, which have been positioned in the proposed table.

A	**0**	**N**	**26**
a	**1**	**n**	**27**
B	**2**	**O**	**28**
b	**3**	**o**	**29**
C	**4**	**P**	**30**
c	**5**	**p**	**31**
D	**6**	**Q**	**32**
d	**7**	**q**	**33**
E	**8**	**R**	**34**
e	**9**	**r**	**35**
F	**10**	**S**	**36**
f	**11**	**s**	**37**
G	**12**	**T**	**38**
g	**13**	**t**	**39**
H	**14**	**U**	**40**
h	**15**	**u**	**41**
I	**16**	**V**	**42**
i	**17**	**v**	**43**
J	**18**	**W**	**44**
j	**19**	**w**	**45**
K	**20**	**X**	**46**
k	**21**	**x**	**47**
L	**22**	**Y**	**48**
l	**23**	**y**	**49**
M	**24**	**Z**	**50**
m	**25**	**z**	**51**

It should be kept in mind that even if the identical three digits are obtained, the associated alphabets would be distinct. Hence, the auto engendered code would be distinct and not identical.

Initially, a three digit number would be specified as input, say, 983.

For apiece time then onwards, a new three digit number would be engendered from the previous one, and in this manner; 983 would become → 983 + (2^9+2^8+2^3) =1759 =759. (Considering only last three digits)

For apiece code, initially three digits would be engendered, and then with the aid of those three digits, the three alphabets would be engendered.

To obtain the three alphabets from the engendered three digits; for the first code, the inputted number is to be used. The last digit of the inputted number '983' is 3 and the corresponding alphabet of 3 is → b.

Hence, the first alphabet for this particular code would be 'b.'

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Then, adding the next digit with the alphabet for obtaining the next alphabet, that is; b+7 → 3+7=10.
Corresponding alphabet for 10 is → F.
Hence, the second alphabet for this particular code would be 'F.'
To obtain the third alphabet, the next digit is added with 'F', that is; F+5 → 10+5=15.
Hence, the third alphabet for this particular code would be 'h.'
In this manner, the three digits (7 5 9) and three alphabets (b F h) are obtained.
Hence, the engendered code is → **b7F5h9**.

For engendering the first code, the inputted number (Here, 983) would be used.
But, after engendering the first code, then onwards, the last engendered code would help in engendering the next code.

As an example, the last engendered code was → **b7F5h9.**

The last engendered code would help in engendering the next code, that is; the three digit part (7 5 9) would help to engender the three digit part of the next code and the three alphabet part (b F h) would help to engender the three alphabet part of the next code.

Using the formula as used previously to engender the auto code;
For apiece time then onwards, a new three digit number would be engendered from the previous one, and in this manner; 759 would become → 759 + (2^7+2^5+2^9) =1431 =431. (Considering only last three digits)
For obtaining the three alphabet part, the last alphabet in the previously engendered three alphabet part was → 'h.'
Hence, the first alphabet for this particular code would be 'h.'
According to the previously adhered formula, the next alphabet would be obtained.
Then, adding the next digit with the alphabet for obtaining the next alphabet, that is; h+4 → 15+4=19.
Corresponding alphabet for 19 is → j.
Hence, the second alphabet for this particular code would be 'j.'
To obtain the third alphabet, the next digit is added with 'j', that is; j+3 → 19+3=22.
Corresponding alphabet for 22 is → L.
Hence, the third alphabet for this particular code would be 'L.'
In this manner, the three digits (4 3 1) and three alphabets (h j L) are obtained.
Hence, the engendered code is → **h4j3L1**.
And so on....

It is to be noted that presuming at some point, the numeric part of the engendered code might become 'a b c', such that, $2^a + 2^b + 2^c = d$ becomes a solitary digit number or a double digit number. But, supposedly it is requisite to work with three digit number, henceforth, enhancing the number 'd' by concatenating requisite number of zeroes before it, would essentially make it a three digit number.
For instance, if at some point, the numeric part would become 1 1 1, such that, $2^1 + 2^1 + 2^1 = 6$, which being a solitary digit number requires enhancing or padding. Enhancing the solitary digit number 6 to a three digit number is ensured by transformation of 6 to 006.

It should be kept in mind that while calculating and obtaining the alphabets, if the number becomes greater than fifty one, then it would once again commence from the start, that is, from 0 → 'A.'

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Demonstration/Illustration of the Entire Process at a Glance:

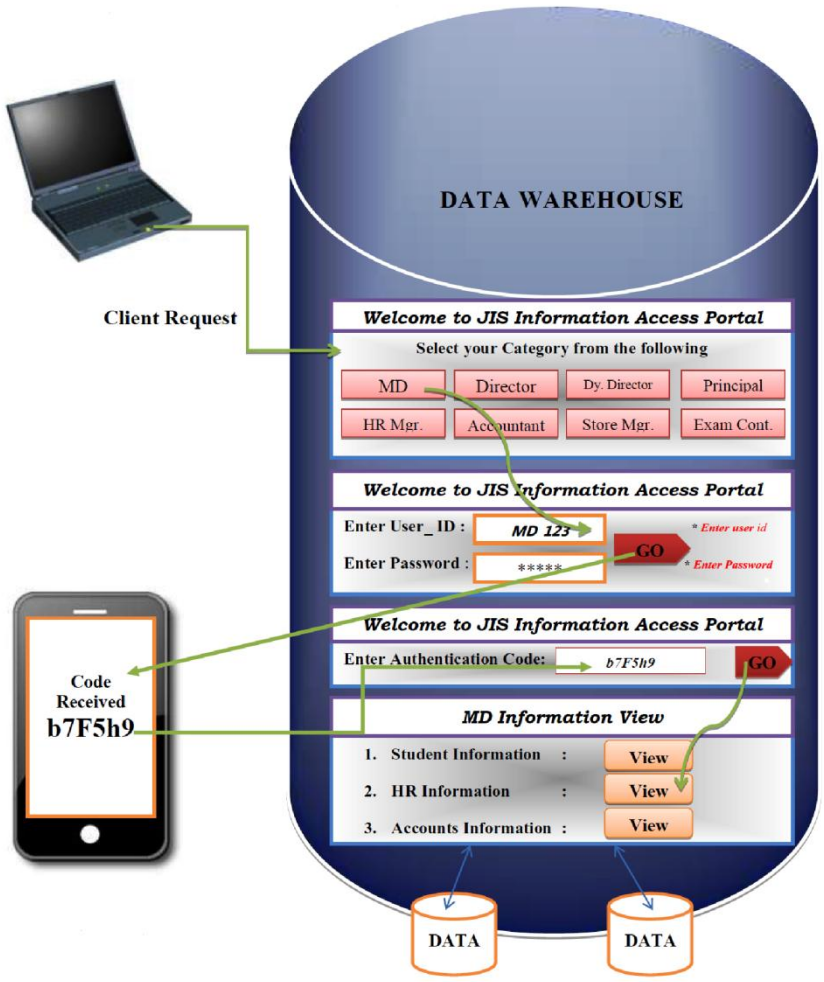

Fig2: Process Diagram Illustrating the Entire Process at a Glance

IV. CONCLUSION

Whenever the term prevention/safety comes in wits and notions, security is synonymous, but from time to time implementing security mechanism(s) like cryptographic techniques, biometric methodologies, quick response code mechanisms, etc. has not only been tough but cost constrained as well. On the other hand, implementation of any security mechanism at internal structure of the warehouse is intricate.

Through the formulation of the paper, discussions as well as illustrations ensure how security could be implemented at distinct level/tier to accomplish towering height of data confidentiality, along with performance enhancement. The multiple level/tier architecture enhances the security aspect of the data exclusively, and enormous proportions of data could be secured with the proposed mechanism, without much of an alteration in internal structural purview.

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BIOGRAPHY

Mr. Rajdeep Chowdhury, Assistant Professor, Department of Computer Application, JIS College of Engineering, Block–A, Phase–III, Kalyani, Nadia–741235, West Bengal, India.

Mr. Rajdeep Chowdhury is presently engaged with pursuing his Ph.D. degree and is registered at Department of Engineering and Technological Studies, University of Kalyani under the supervision of Dr. Mallika De. Mr. Chowdhury was awarded Masters of Computer Application (MCA) from JIS College of Engineering under West Bengal University of Technology. Mr. Chowdhury's fields of interest include Network Security and Cryptography, Database Management System, Data Warehouse and Data Mining. Mr. Chowdhury has authored/co-authored several research articles/papers in refereed National/International Journals and National/International Conferences. Mr. Chowdhury has worked as Reviewer for few National/International Conferences as well as National/International Journals and has been part of Editorial Boards as well. Mr. Chowdhury has been recipient of numerous Awards and Honour by Corporate bigwigs and Academia. Few notable of which being; Winner at INSPIRE-Infosys Faculty Contest Series/INSPIRE–Infosys Faculty Excellence Awards in 2012 and 2013, Certificate of Recognition for Outstanding Contribution by Infosys for the year 2011-2012, Top Practitioner at Wipro Mission 10X Bookrack, Best Paper Awards in many National/International Conferences and Contests, etc.

Mr. Prasenjit Chatterjee, Student, Department of Computer Application, JIS College of Engineering, Block–A, Phase–III, Kalyani, Nadia–741235, West Bengal, India.

Mr. Prasenjit Chatterjee is currently pursuing Masters of Computer Application (MCA) from JIS College of Engineering, Kalyani.

Mr. Chatterjee's fields of interest include Network Security, Cryptography and Data Warehouse.

Mr. Chatterjee in association with Mr. Chowdhury has recently won the Best Poster Paper Award in IEEE International Conference on Non Conventional Energy (ICONCE 2014) on 17.01.14.

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Ms. Pubali Mitra, Student, Department of Computer Application, JIS College of Engineering, Block–A, Phase–III, Kalyani, Nadia–741235, West Bengal, India.
Ms. Pubali Mitra is currently pursuing Masters of Computer Application (MCA) from JIS College of Engineering, Kalyani.
Ms. Mitra's fields of interest include Data Warehouse, Data Mining and Database Management System.

Mr. Olive Roy, Student, Department of Computer Application, JIS College of Engineering, Block–A, Phase–III, Kalyani, Nadia–741235, West Bengal, India.
Mr. Olive Roy is currently pursuing Masters of Computer Application (MCA) from JIS College of Engineering, Kalyani.
Mr. Roy's fields of interest include Cryptography and Data Warehouse.