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An Enhanced E-Contract Profiling System

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Abstract: Electronic contract is a contract modeled, specified, executed and enacted (controlled and monitored) by a software system. The conventional method of managing contracts involves risk and chaos which include inadequate information about the contracts; poor delegation of authority and responsibility; fraud, theft, corruption etc. Indeed, these and other unethical activities delay prompt financial decisions regarding the contracts thereby affecting effective execution of projects. The new system developed is an enhanced e-contract profiling system for government projects which can improve the management of government contract, thereby ensuring transparency, effective monitoring, control, fair selection of bidders, central storage of contract document, reduced cost of transactions and increase efficiency. The software development methodology for this work is object oriented hypermedia methodology and the programming language used is PHP; with MYSQL as the database at the back end. The system developed can recommend a contractor for a project and also profile the percentage of completion of contracts when awarded.

Keywords: *E-Contract System*

I. INTRODUCTION

In recent years, there is an explosion of business applications exploiting Internet and Web as a medium. Business trends have been observed from on-line shopping (Business-to-Customer, B2C) to on-line auctions to Business-to-Business (B2B) interactions. Electronic contracts (or simply e-contracts) helps in building such new business relationships and fulfill contractual agreements through electronic contracting systems. E-contracts enable precise specification of contractual activities, terms and conditions, compliance checking and enforcement. In addition to legal binding between parties, e-contracts are also used across different workflows systems to fulfill (cross-) organizational business processes (Koetsier et al., 2000) and integrating different web services (Chiu et al., 2003). Thus, an e-contract is viewed from a simple electronic contract document to a computerized facilitation or automation of a contract.

With the advent of e-commerce, many online business transactions involve both implicit and explicit contracts that are accepted by entities involved in the transactions. For example, buying a book in an online store implies signing the corresponding return policy contract. One of the key difficulties with any kind of contract processing is the legal ambiguity, which makes it difficult to address any violation of the contract terms. This is because not having sophisticated mechanisms to track and ensure contract enactment according to its specification. Therefore, contract handling requires conceptual modeling support to make the intricate details and implications of contract explicit for easy comprehension and implications, and to facilitate the design of comprehensive information systems to enact the contract in an organization. In many organizations, contracts and enactment of contracts are handled by disparate systems. The automated support of contract enactment through an e-contract management system drives the effectiveness and efficiency in contract management.

A. Contract Lifecycle

There are several stages involved in a contract such as exchange of information and negotiation, before the execution of the contract. A contract will define a set of activities to be performed by parties satisfying a set of terms and conditions (clauses).

Traditionally, contracts are voluminous documents that are created, executed and managed via paper-based methods. These contracts incorporate certain commitments made by the involved parties. For example, in a buyer-and-seller contract, the buyer agrees to purchase certain goods, whereas the seller agrees to supply goods of a certain quality. However, a contract between two or more business partners can be much more complex than the buyer and seller transaction. Such a contract may have different phases like identifying business partners; matching offers against requirements; negotiating terms, conditions and pricing; signing; and execution. Figure 1.1 illustrates the contract lifecycle

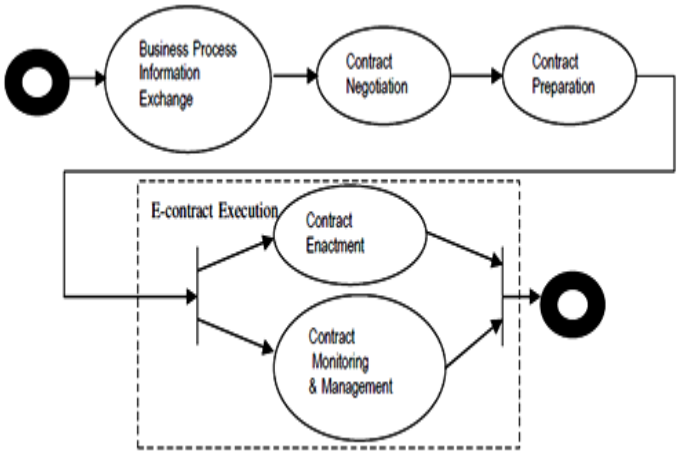


Fig 1.1: Contract Lifecycle

II. REVIEW OF RELATED LITERATURE

An electronic contract (e-contract) is an agreement created and signed in electronic form without using any paper or other hard copies (Shell, 2001). It is a contractual agreement, represented as digital information and signed with the electronic or digital signatures of the participating parties (Xu, 2004). There exist different descriptions for the e-contracting process (Milosevic & Bond, 19995) (Herring & Milosevic, 2001), the general e-contracting process includes two stages: contract establishment (contract formation) and contract enactment (contract performance or contract fulfillment) (Angelov, 2005; Xu, 2004). E-contracting activities such as identifying, checking and validating of contractual parties, negotiation and validation contract, are included in the stage of contract establishment. The contract enactment is further separated into two phases: performance and post-contractual activities. Monitoring of

contract performance and compensation activities belong to the contract performance phase while contract enforcement may be involved in both the contract performance and post-contractual activities.

In the literature, a lot of work has been done in e-contract negotiation and business process support. Weigand et al., (2003) presented a support system for carrying out negotiations for business-to-business transactions.

Schoop (2002) presented non-automated negotiation support models to support human negotiators in their complex negotiation process in the document management for e-contracting. Xu (2004) described a temporal logic based formalism to support contract commitments. However, authorization can be supported by specifying roles to concerned parties.

Ayodele et al., (2013) worked on automating and streamlining the procurement process in order to: reduce the time and cost of doing business for both vendors and government; realize better value for money spent through increased competition and the prevention of cartel formation; standardize the procurement processes across government departments/agencies; allow equal opportunity to all vendors; bring transparency and ultimately reduce corruption.

Manju and Pramila (2013) worked on Intelligent Contract Management that focused on streamlining the business process by reducing the time taken to create, review, execute and approve contracts; thus easing activities like tracking, central storage of contract documents, and reduction in disputes, minimize risks associated with manual data entry.

Kalliopi et al., (2010) worked on Contract Agreement Policy-based Workflow Methodology for Agents Interacting in the Web. This agreement allows each agent to have its own policy, a set of private rules representing its requirements, obligations and restrictions, depending on its role in the e-Contract, as well as its personal data.

III. METHODOLOGY ADOPTED

The software development methodology adopted for this work is Object Oriented Hypermedia Design Method (OOHDM). Object Oriented Hypermedia Design Method is a methodology for the development of Web applications. The Object-Oriented Hypermedia Design Method (OOHDM) (Schwabe, 1996) uses abstraction and composition mechanisms in an object oriented framework to allow a concise description of complex information items, and for the specification of complex navigation patterns and interface transformations. In OOHDM, a hypermedia application is built in a four-step process that favours the use of an incremental or prototype process model. Each step focuses on a particular design concern, from which an object-oriented model is built. Classification, aggregation and generalization/specialization are used throughout the process to enhance abstraction power and reuse opportunities. Figure 3.1 shows a high level model of the system developed. Figure 3.1: Shows the High level Model of the System

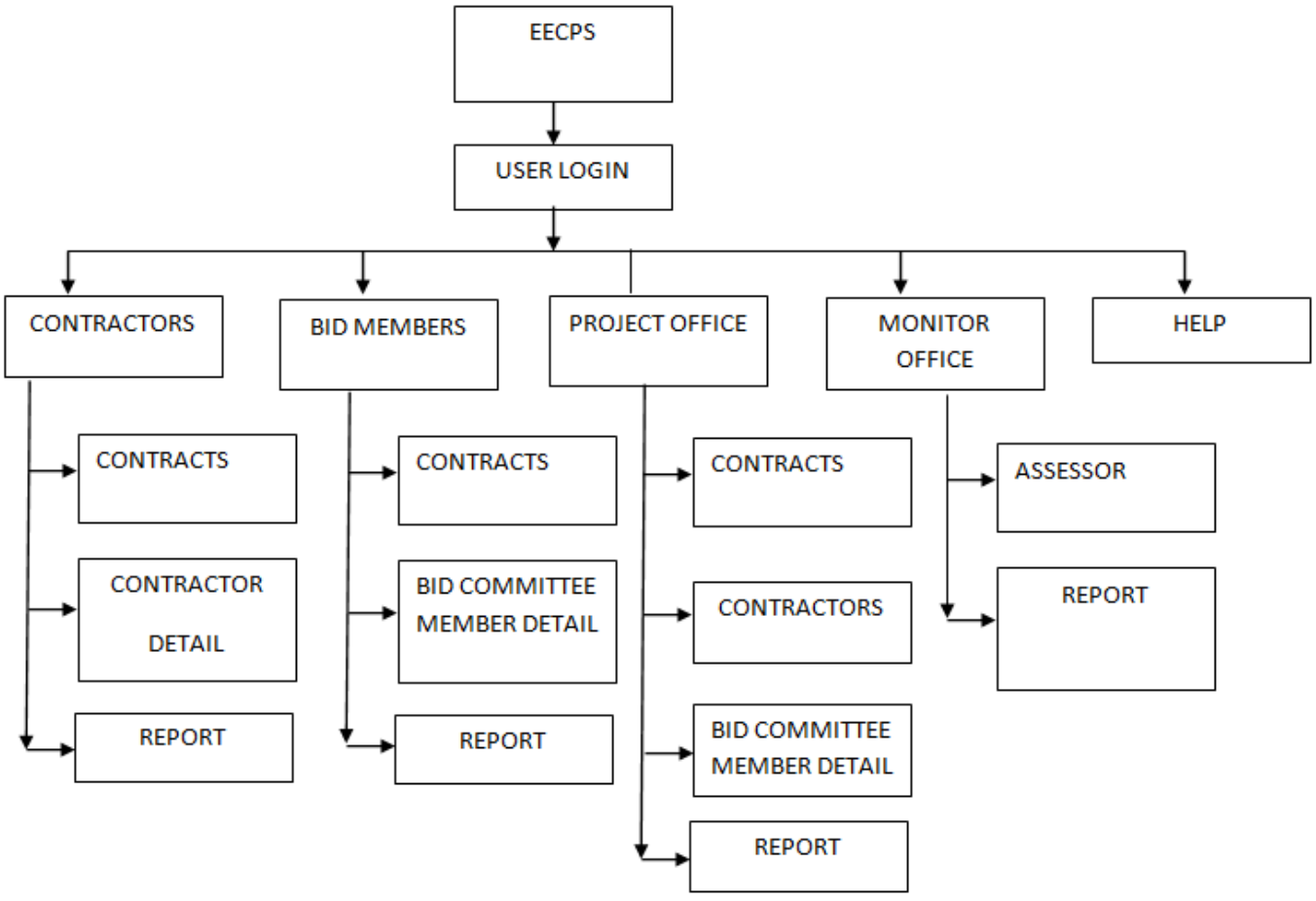


Figure 3.1: High level Model of the New System

A. Software Model

The software model was developed using a text editor called Notepad++ and WAMP Server 2.1 which runs Apache Server 2.2.1, MySQL 5.5.8 and PHP 5.3.5 interpreter was employed to execute incremental development of EECPS.

B. Design and Implementation

Generally, Use Case diagram graphically depict the interaction between the system and the users. The diagram graphically decides who will use the system and in what ways the user expects to interact with the system. In figure 5.1 the user interaction diagram of the use case describes only the exchange of information between the system and the user without considering specific user interface.

Figure 5.2 shows the conceptual schema of the system (EECPS) synthesized from the user interaction diagram and UML is used to represent the conceptual schema (class diagram); which consist of classes of the system, their interrelationship and methods and attributes of the class. Few interfaces and reports from the software application development are captured in the results and discussion section.

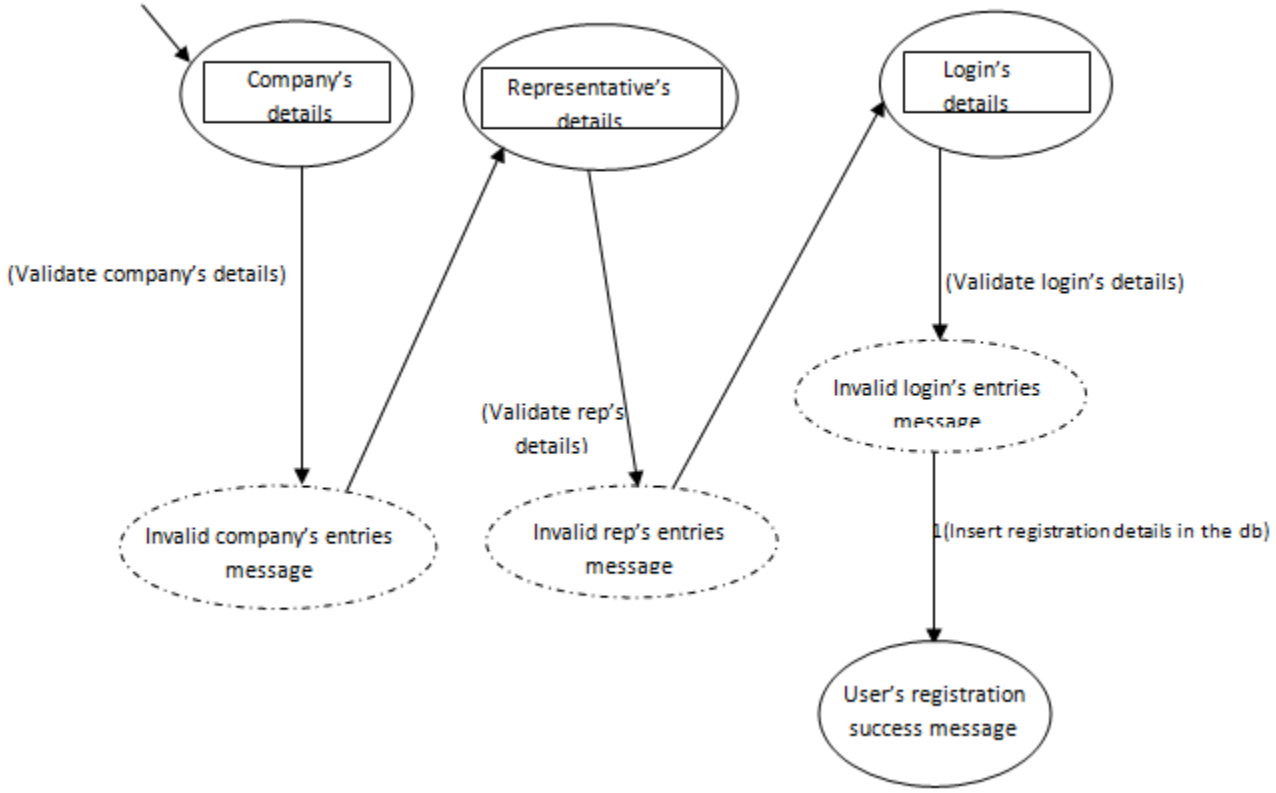


Figure 5.1: user interaction diagram

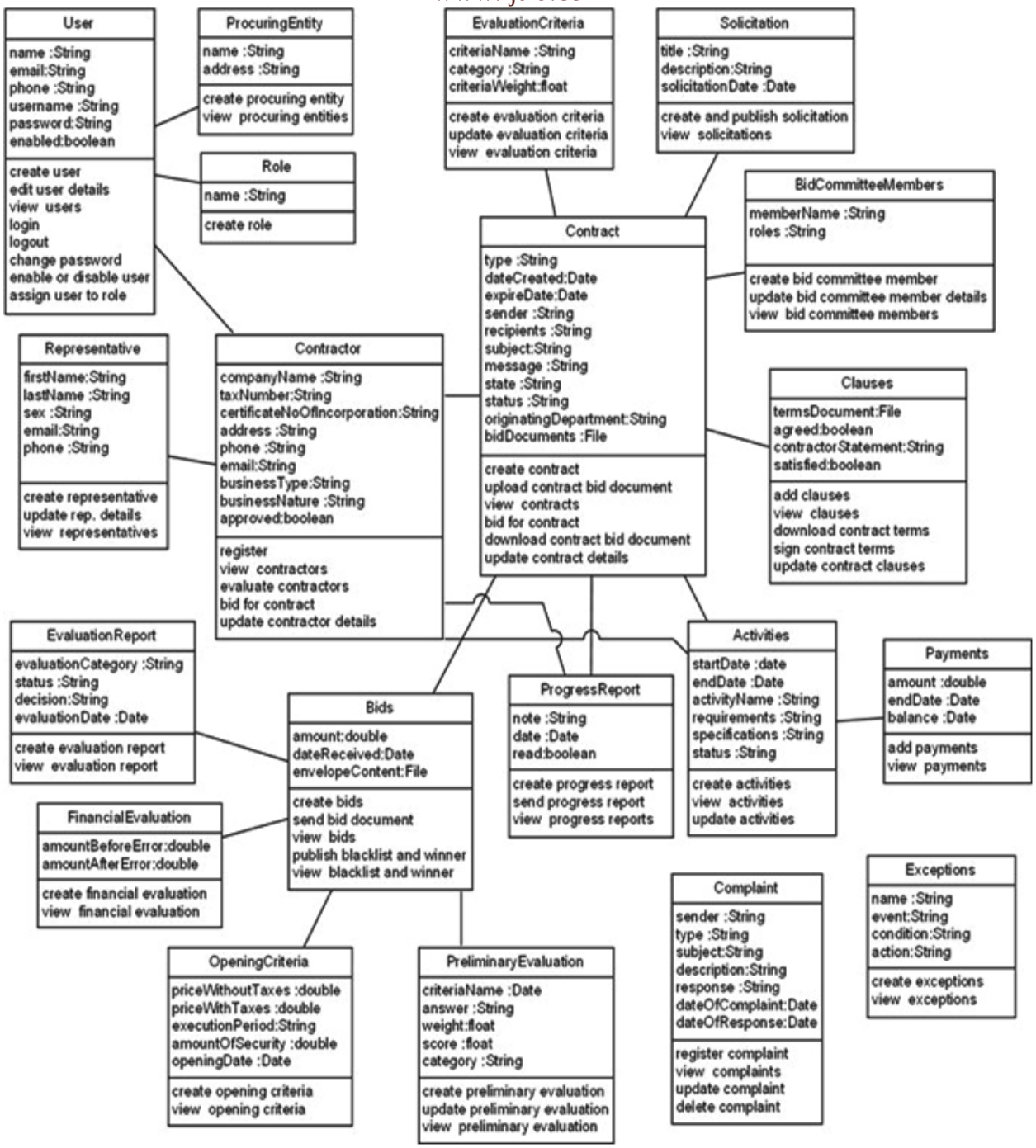


Fig 5.2: Class diagram of the System

IV. RESULTS AND DISCUSSION

An effective e-contract profiling system has been designed and implemented. A contract was prepared. Different contractors bided for the contract before the deadline. Bid committee members were assign randomly to all contractors and their assessment was submitted. The e-contract system adds the scores of all bid committee members for a contractor and gets the average. The contractor with the highest average is recommended by the system to get the contract.

Remote access to the system via Internet enables speedy output. The contractors would not have to wait until the paperwork is processed. The automated workflow comes handy in timely decision making and thus eradicating the manual effort involved. It may also help in tracking the changes in the contracts and the owner of the contract changes. A history of contacts can be maintained which may prove useful in evaluation of partners in future.

In figure 6.1 is the home page that is displayed when the application is loaded to enable the users of the system to select a button that will lead them to other pages of the application.

A. Home Page

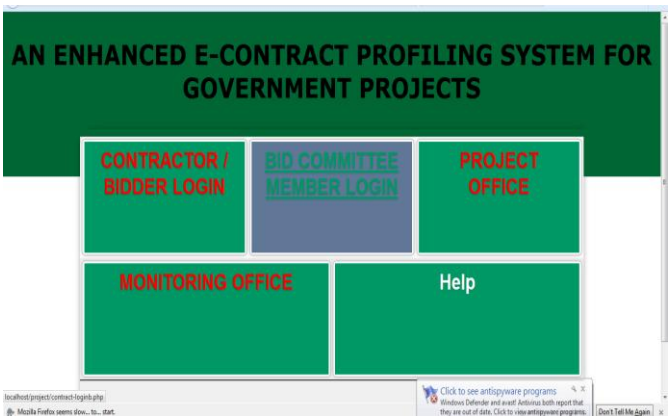


Figure 6.1: Guest/Home Page

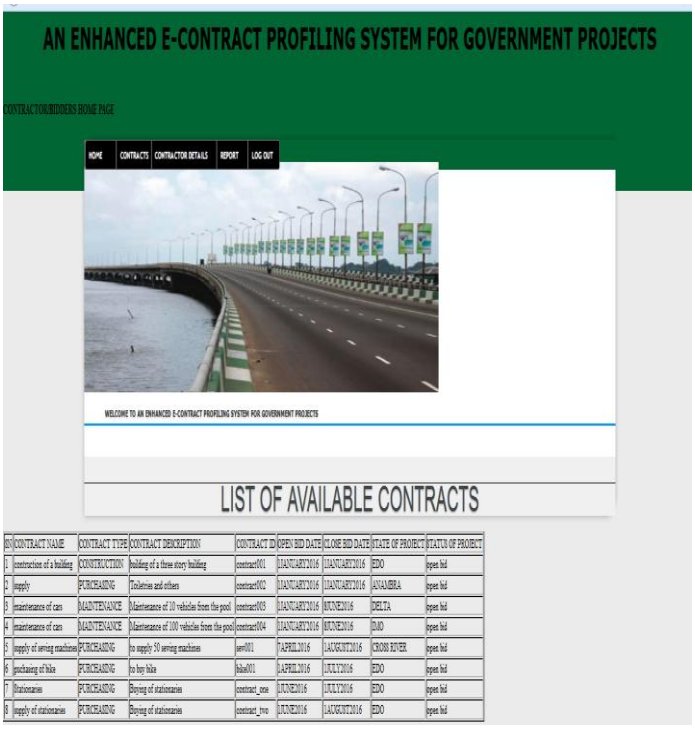
The page in figure 6.2 is the login page that gives a user access to the application when the correct password inputed is valid

B. Users Login Page

Figure 6.2: Users Login Page

Figure 6.3 is the contractor/bidders home page where list of available contract that is to be advertised is displayed so that those contractors that are qualified can bid for the contact

C. List of open Contracts

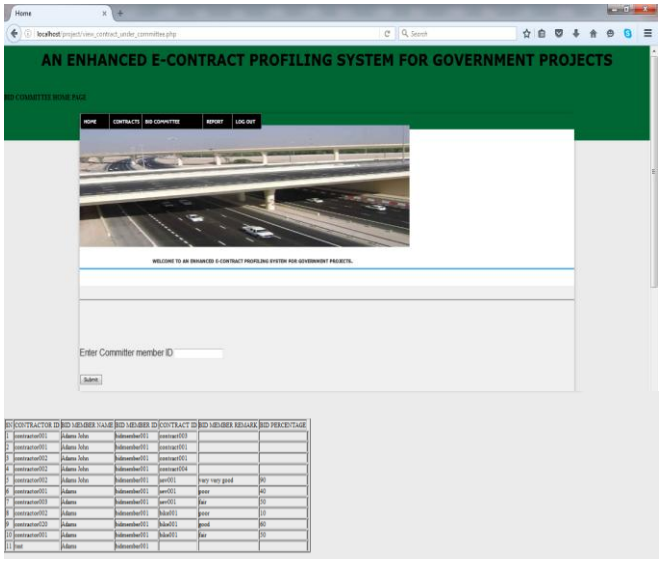


S/N	CONTRACT NAME	CONTRACT TYPE	CONTRACT DESCRIPTION	CONTRACT ID	OPEN BID DATE	CLOSE BID DATE	STATE OF PROJECT	STATUS OF PROJECT
1	construction of a building	CONSTRUCTION	building of a three story building	contract001	15/JAN/2017	18/JAN/2017	EDO	open bid
2	supply	PURCHASING	Toiletries and others	contract002	15/JAN/2017	18/JAN/2017	ANAMBRA	open bid
3	maintenance of cars	MAINTENANCE	Maintenance of 10 vehicles from the pool	contract003	15/JAN/2017	18/JUNE/2016	DELTA	open bid
4	maintenance of cars	MAINTENANCE	Maintenance of 100 vehicles from the pool	contract004	15/JAN/2017	18/JUNE/2016	IMO	open bid
5	supply of sewing machines	PURCHASING	to supply 50 sewing machines	aer001	7/APRIL/2016	14/AUGUST/2016	CROSS RIVER	open bid
6	purchasing of bike	PURCHASING	to buy bike	bike001	1/APRIL/2016	1/JULY/2016	EDO	open bid
7	Stationaries	PURCHASING	Buying of stationaries	contract_yoo	1/JUNE/2016	1/JULY/2016	EDO	open bid
8	supply of stationaries	PURCHASING	Buying of stationaries	contract_two	1/JUNE/2016	14/AUGUST/2016	EDO	open bid

Figure 6.3: List of open Contracts

The page in figure 6.4 is the bid member home page where they give remark/comments for contractors assigned to them that bided for a contract.

D. Bid Member Home Page



S/N	CONTRACTOR ID	BID MEMBER NAME	BID MEMBER ID	CONTRACT ID	BID MEMBER REMARK	BID PERCENTAGE
1	contractor001	Adamu John	bidmember001	contract003		
2	contractor001	Adamu John	bidmember001	contract001		
3	contractor002	Adamu John	bidmember001	contract002		
4	contractor002	Adamu John	bidmember001	contract004		
5	contractor002	Adamu John	bidmember001	aer001	very very good	90
6	contractor001	Adamu	bidmember001	aer001	poor	40
7	contractor003	Adamu	bidmember001	aer001	fair	50
8	contractor002	Adamu	bidmember001	bike001	poor	10
9	contractor020	Adamu	bidmember001	bike001	good	80
10	contractor001	Adamu	bidmember001	bike001	fair	50
11	test	Adamu	bidmember001			

Figure 6.4: Bid member remarks for project assigned

Figure 6.5 and 6.6 are the project office home page where the user in charge of the office can place a new contract, add a bid committee member to be able to analyze tenders submitted by each contractors, and also blacklist an earring contractor, view all reports/request submitted etc

E. Project Office Home Page

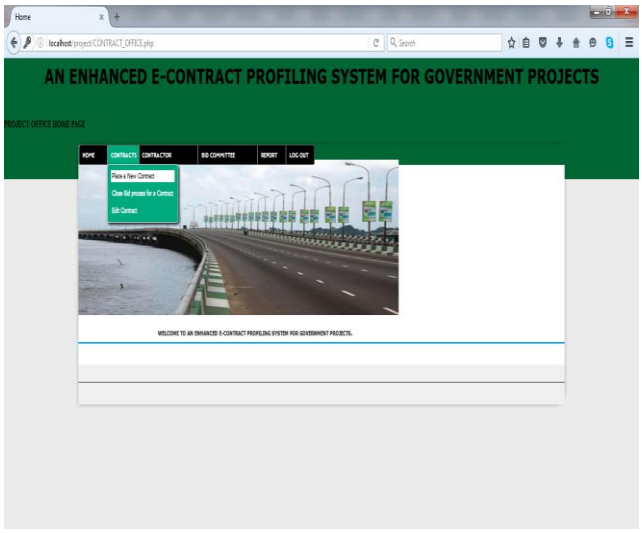
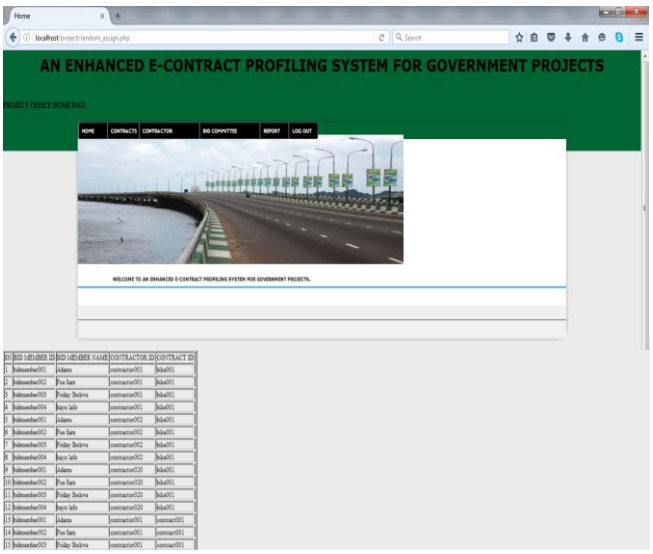


Figure 6.5: Project office home page



S/N	BID MEMBER ID	BID MEMBER NAME	CONTRACTOR ID	CONTRACT ID
1	bidmember001	Adamu	contractor001	bike001
2	bidmember002	Pro Sam	contractor001	bike001
3	bidmember003	Friday Ibekwe	contractor001	bike001
4	bidmember004	bayo lafe	contractor001	bike001
5	bidmember001	Adamu	contractor002	bike001
6	bidmember002	Pro Sam	contractor002	bike001
7	bidmember003	Friday Ibekwe	contractor002	bike001
8	bidmember004	bayo lafe	contractor002	bike001
9	bidmember001	Adamu	contractor020	bike001
10	bidmember002	Pro Sam	contractor020	bike001
11	bidmember003	Friday Ibekwe	contractor020	bike001
12	bidmember004	bayo lafe	contractor020	bike001
13	bidmember001	Adamu	contractor001	contract001
14	bidmember002	Pro Sam	contractor001	contract001
15	bidmember003	Friday Ibekwe	contractor001	contract001

Figure 6.6: Randomly assigned bid members to projects

Figure 6.7- 6.9 is the report generated showing all the contractors that bided for a contract and the amount to execute the project, each comment submitted by each bid member committee and the contractor that won the contract. All views are done by the project office

F. Project Office- View Contract Bided For

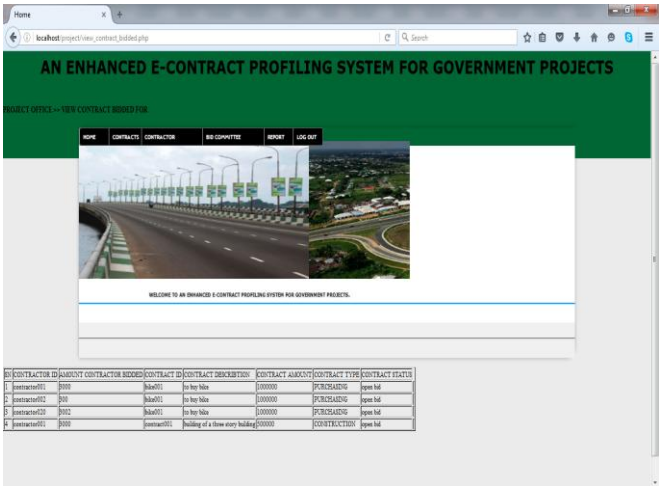


Figure 6.7: Show all contracts bided for, the amount and the contractors

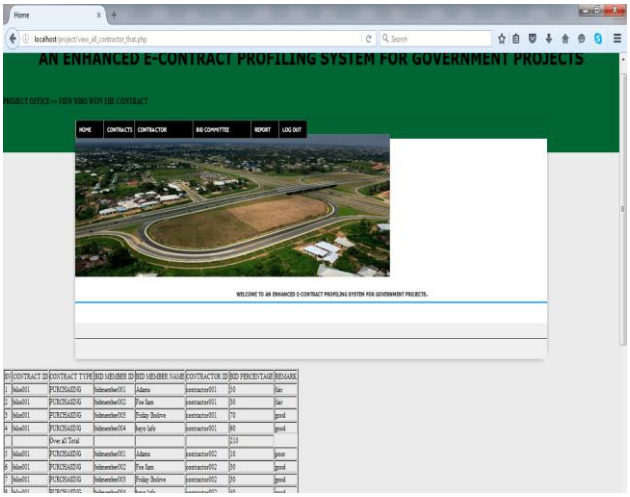


Figure 6.8: View the remark entered by the bid committee members

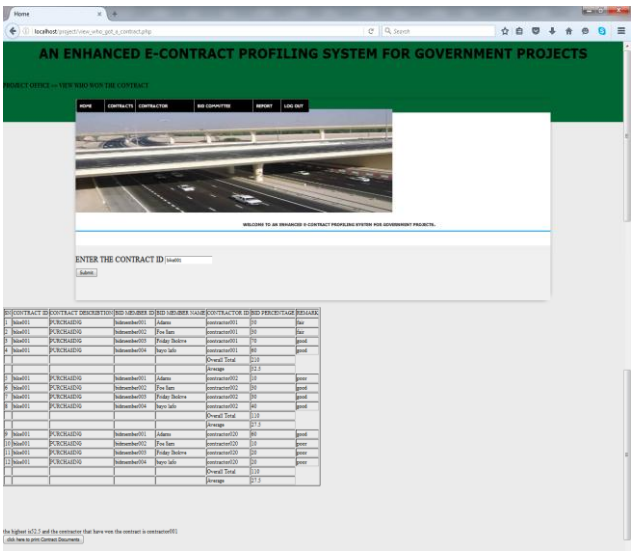


Figure 6.9: View who won a contract

CONCLUSION

There has been a great need over the years for the contract activities of the Nigerian government to be automated in order to be able to facilitate work effectiveness, efficiency, reduce cost, and increase accountability. The new e-contract profiling system developed can improve management of government contract processes, thereby ensuring transparency, effective monitoring, control, fair selection of bidders, reduced cost of transactions and increased efficiency.

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