e-Bidding System for Budgetary Governmental Organizations in Ethiopia

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Abstract

Design and development of an electronic bidding system is an effort to improve and enhance public procurement in Ethiopia following rigorous system development methodology.

The system development uses standardized public procurement proclamation, its directive and manual that govern public bodies in a purchasing process. In addition, the system development follows a case study approach conducted on Ethiopian Roads Authority to elicit requirement, design, and implement the system.

The developed system will result in increasing transparency, accountability, and significantly increase the efficiency in public procurement process.

Keywords: Online Bidding; Public Procurement; Public Procurement Process; E-Government Procurement

1. Introduction

Recently, Information and Communication Technology (ICT) is considered as one of the key elements to facilitate the economic growth of a country. According to [1], ICT offers increased opportunities for economic development and plays a critical role in rapid economic development and change.

Public procurement is the acquisition of goods and/or services by public bodies. The primary objective is acquiring the right product or service, at the right price and quality at the right time in a fair and transparent manner. However, mostly procurement processes are known for being highly vulnerable to corruption and the process is opaque and slow. To minimize these, government organizations should have to disseminate as much information as possible about overall bidding process – advertisement till award. In order to give assurance of fair process, the organization and its personnel shall follow a standard procedure in carrying out the procurement process and the result has to be notified to all interested parties.

In this regard, e-biding system is designed to store profile of bidders in their respective specialization area; advertise new bids; accept bid proposal electronically; semi-automatic bid proposal evaluation; and notify bidders about bid evaluation result. The use of e-bidding system reduces errors and human subjective judgments and also ensures greater transparency and accountability in public procurement of goods and services. It ensures greater participation as well as security of bid and related documents.

The development of the system is done on a specific case study conducted on Ethiopian Roads Authority. The case study has been used to identify the real procurement problems and to understand the detail requirements of the system.

The rest of this paper is organized as follows. Section 2 discusses the background in the area of public procurement in Ethiopia. Section 3 assesses related works in the area of electronic government procurement systems. Section 4 describes the requirements of the online bidding system. Section 5 introduces the system analysis and design of the system. Section 6 describes the implementation of the system. Finally, Section 7 provides conclusion.

2. Background

The Federal Government of Ethiopia has revised the Public Procurement Proclamation and reestablished Public Procurement and Property Administration Agency (PPPAA) in 2009 [2]. The issuance of the new proclamation (procurement and

property administration proclamation No_649/2009) has a significant improvement in the process of creating an efficient and effective legal framework for public procurement in Ethiopia.

The domain of the proclamation lies for any public body which is financed by the federal government budget [3]. The procedures and practices presented in this paper have been developed in accordance with the provisions of the Proclamation and its Directive.

In Ethiopia, public bodies are the biggest buyers in the country. Typically, government purchases are characterized by large value and volume, cumbersome paper work, long lead times and approval processes.

Public bodies have a unified set of bidding regulations. Businesses seeking to contract with public bodies face different set of procurement rules and regulations. Thus, both bidders and public bodies are often faced with different key bidding requirements such as timing, advertising, bid content, amendments and award, etc. Practically any diversion from these, often conflicting, requirements causes challenges and results in delays to the public procurement process.

Errors are most commonly made by bidders when submitting bid proposals issued by public invitations. The most common mistakes that bidders make when submitting a proposal are failing to include all forms (requirements) at the time of submission to possess the required licensing and registration required by the bidding document (e.g., VAT registration, Trade License, etc…), and not respecting submission deadline. Besides, public bodies may not have information about potential bidders specializing on the context of the auction and the number of bidders is very limited caused mainly due to shortcoming of traditional information dissemination mechanism.

The e-bidding system is designed to address these issues by replacing the existing paper-based system with a modern information system.

3. Related Work

In this paper, we have reviewed the experience of some mature Electronic Government Procurement (E-GP) systems across the world such as IFMIS in Ethiopia [4], KONEPS in Korea [5], Merx in Canada [11], West Bengal government e-tendering system of the Government of Tamil Nadu [7], Maharashtra tenders in India [6], Public e-tendering in Portugal [8], SA Tenders & Contracts in South Australia [9], and Tender Ned in The Netherlands [10].The experience of these countries is used as a benchmark for our system and shows the extent and expectation of the work done. However, it is not possible to get detailed information about security of some of the systems.

Table 1 shows the comparison among the existing E-GP systems with basic system features to be supported by our e-bidding system.

In general, our system has the following distinct features. It is an initial work on electronic government procurement system in Ethiopian context based on Ethiopian public procurement proclamation, its procedures and manual; and it can be operated in Amharic and English languages.

Table 1: Comparison between E-government procurement Systems and our bidding System

E-GP systems / *System Features*	*IFMIS*	*Koneps*	*Maharashtra tenders*	*West Bengal Gov't e-tendering system*	*VortalGov*	*SA tenders & contracts*	*Tenderned*	*Merx*
User-friendly interface	√	√	√	√	√	√	√	√
Advertisement		√	√	√		√	√	√
online tender document distribution		√	√			√		√
Registration		√	√	√	√	√	√	
Downloading of tender documents			√	√	√	√		√
online submission		√	√		√	√	√	√
send and receive					√	√		

E-GP systems / System Features	IFMIS	Koneps	Maharashtra tenders	West Bengal Gov't e-tendering system	VortalGov	SA tenders & contracts	Tenderned	Merx
messages								
Feedbacks						√	√	
Automatic Notifications				√	√	√	√	√
Amendment						√	√	√
online Award					√	√	√	
online Help						√	√	
Report Generation	√							

4. Requirements of the System

The methodology adopted in this system is a case study conducted in Ethiopian Roads Authority which has a huge amount of international and local purchases in each budget year and can represent other governmental organizations.

In this paper, several fact finding methods have been employed – interviewing key personnel, primary data collection from offices, document observation, direct observation, and secondary sources were used. We have used the information obtained from questionnaire, reports, public procurement proclamation, and Federal public procurement directive. Based on the case study, we have identified the functional and non-functional requirements of the system.

4.1 Functional Requirements

The system is expected to provide the following important functionalities.

1. The system shall allow registration of system users.
2. The system shall assist users in the preparation of bid documents and advertisements in a standard way.
3. The system shall allow registered and paid users to download standard bidding documents.
4. The system helps prepare process by automatically preparing notifications, send these notifications through emails. E-mail is necessary to communicate with bidders who do not always visit the site, when a message needs to be delivered.
5. The system shall allow bidders to submit, substitute or withdraw their bid proposal.
6. The system shall present the bid opening after the closing date that deemed appropriate to strengthen transparency.
7. The system shall keep bidders' data confidential.
8. The system shall undertake evaluation of bid proposals.
9. The system grants contract awards online. Bidders are able to view the outcomes of bidding.
10. The system shall maintain complaints and feedback of bidders about the overall bidding process and responds.
11. The system shall operate both in English and Amharic.
12. The system shall generate reports and its result is provided for all interested parties.
13. The system shall provide online help facility.
14. The system shall provide email based communication facility.

4.2 Non-Functional Requirements

For an efficient, correct, and robust operation of the system, some additional non-functional requirements emerged as necessary. These requirements are not directly related to functionality.

1. The system shall have easy to use user interface.
2. The system shall authenticate and authorize users.
3. The system shall provide response within shorter time – maximum of 3 minutes.

4. The system shall allow users from wrongdoing in entering inputs.
5. The system is reliable in providing accurate information to users.
6. The system shall be designed using standardized software development procedure.

Security of the system

The system's policy dictates that advertisement is accessible to the public at large. For open bidding, any public user can view the advertisement information and will get the opportunity in registering or creating a user account. For restricted bids, an invitation is send directly to potential bidders who are selected from the suppliers list in a fair and transparent manner.

The use of a unique username and password to identify bidders may be sufficient for authentication. Thus only authenticated bidders will be allowed to access secure system resources. The system provides different access levels to users. Access control mechanisms are used to enforce these rules.

In addition to this, there will be auditing mechanism. This is particularly important to address the issue of accountability.

5. System Analysis and Design

This section describes the design of the system with Object Oriented System analysis principles and UML based documentation. UML is a standard set of notations for representing models. At the center of the UML are its different kinds of modeling diagrams: use case, class, and sequence diagrams. Due to space limitation we provide only some of them.

5.1 Use Case Model

A use case diagram describes the functionality of the system from the user's point of view. Figure 1 shows use case diagram for the auctioneer. The main purpose of a use case diagram is to show what system functions are performed for which actor.

5.2 Dynamic Model

To illustrate the interaction of different entities and classes of the system, sequence diagram is used. Sequence diagrams are used to formalize the behavior of the system and to visualize the communication among objects. They are useful for identifying additional objects that participate in the use cases. Figure 2 shows the sequence diagram for the registration use case in the bidding system.

Figure 1: UML Use case diagram for Auctioneer

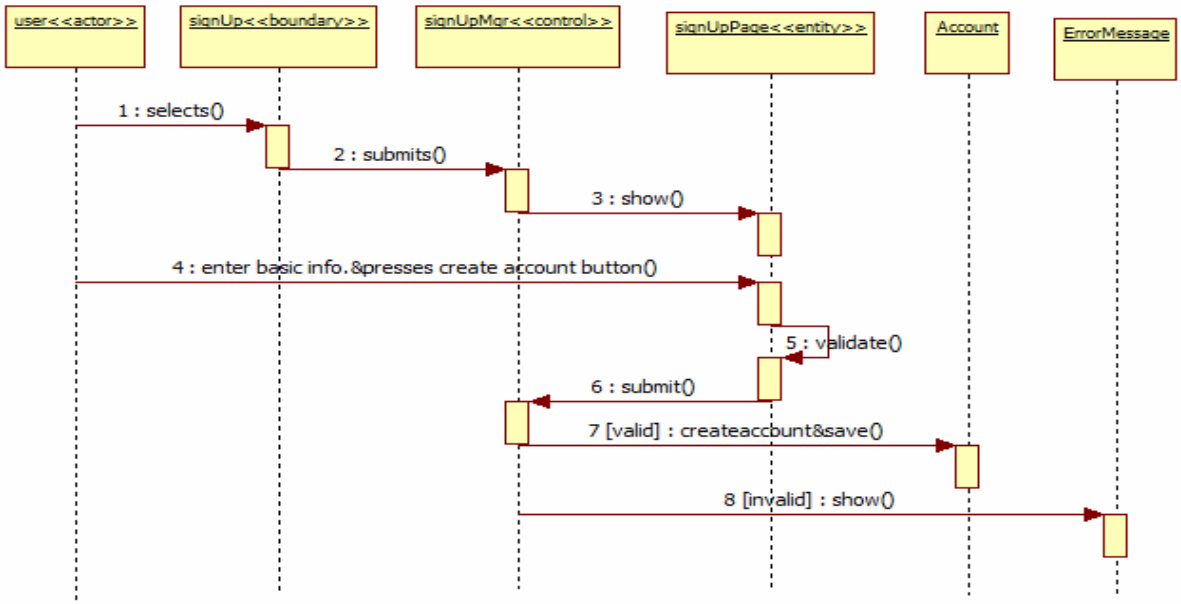

Figure2: Sample Sequence diagram of Registration Use case

5.3 System Architecture

In the requirements section, functional and non-functional requirements were discussed. Now we provide a short summary of some design issues and their implications on system architecture.

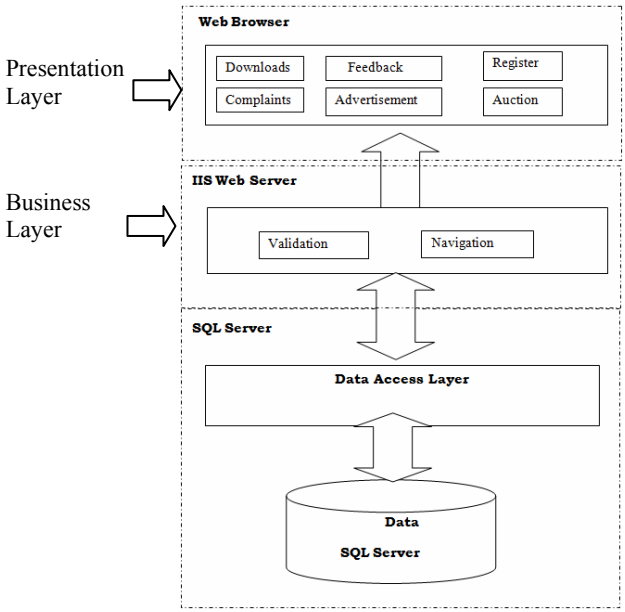

Figure 3: Architecture of the System

The core e-bidding system consists of a number of interacting software components that together make it possible to conduct, administrate, and evaluate bid proposals. The system architecture anticipated in this paper is three tier client server having presentation, business, and data access.

For reasons of efficiency and robustness, IIS was chosen as web server to handle the secure communication with the clients and to dispatch their requests to the respective components behind the firewall. The system is residing on this server which is protected through firewall. As shown in Figure 3, the IIS web server facilitates the communication between other components of the system and users. Users communicate with the system using web browsers. The IIS web server is the central part of the system and controls the system. It reads data from the database and cooperates with clients to provide them with dynamic information about the auctions, receives their bids.

In this system the data is stored in SQL server. SQL server is used to store all the relevant permanent data about the auctions and all related data. The Asp components can easily access this database via Ado.Net.

It is important that the data is used consistently throughout the components. Communication is well supported and that the system is as flexible and platform independent. Therefore, we used Asp.Net as implementation language for the system components.

5.4 Subsystem Decomposition

System decomposition into subsystems is a major design effort that is at the very core of system construction. How a system is decomposed into subsystems has major impact on the quality of the system as well as on the cost of development. Relatedness in use case model, responsibility in providing service, and extent of cohesion are key parameters used in decomposing the system to subsystems.

As shown in Figure 4, the system is further decomposed into subsystems. In view of that seven subsystems are identified: User management and Security subsystem, Advertisement subsystem, Document management subsystem, Evaluation subsystem, Clarifications, complaints and feedback subsystem, Report subsystem, and Email and Notification subsystem. Each of these subsystems are composed of different classes to attain the different functionalities stated in Section 4.

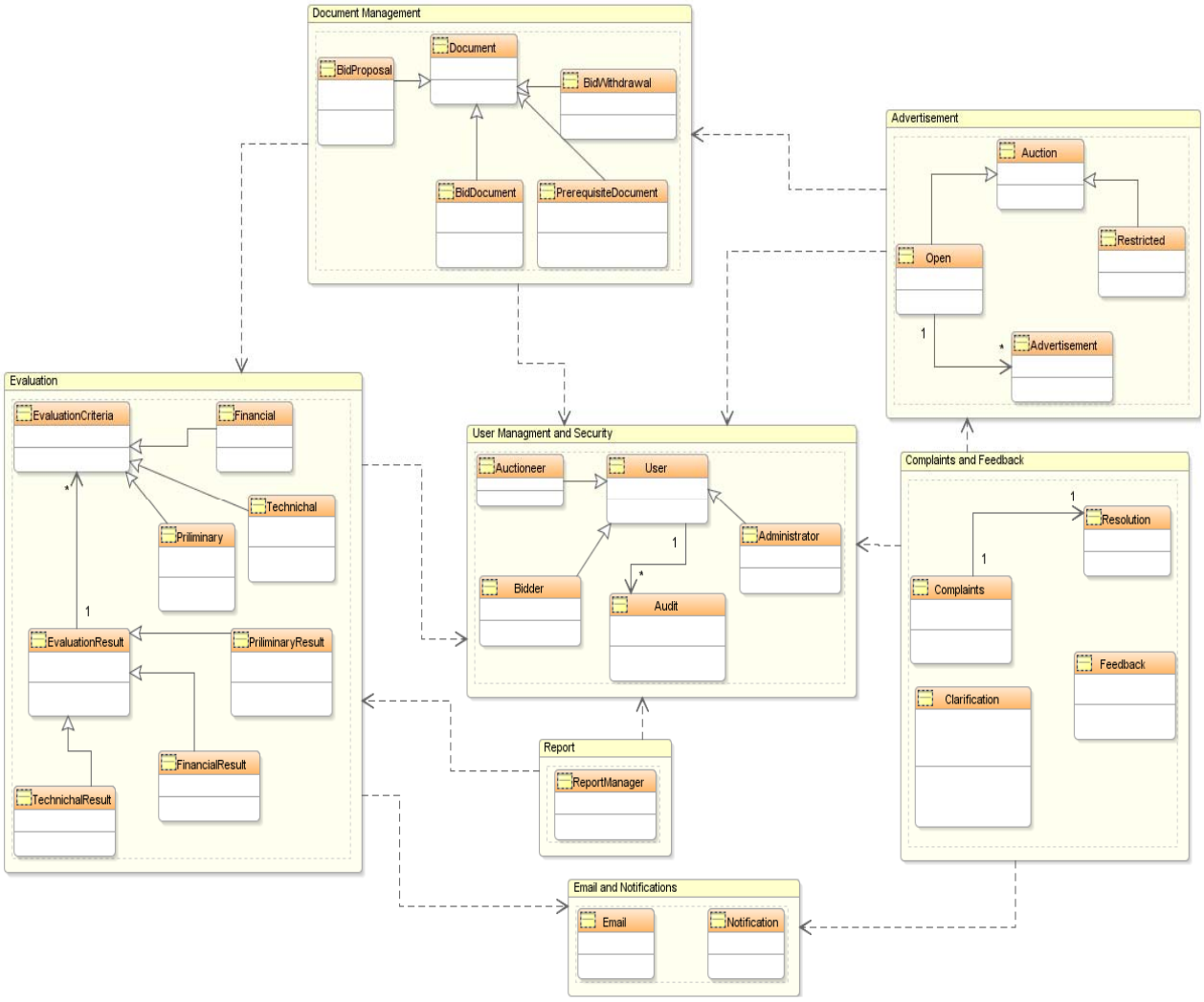

Figure 4: Subsystem decomposition diagram

5.5 Persistent Data Management

Persistent data management deals with identifying the backend technology and designing suitable persistence for the identified classes. In this design, the system was implemented using Relational Database Management System and SQL Server 2008 is used as the backend DBMS. Our choice is based on the technologies flexibility, fast storage and ease of use. Figure 5 shows tables and associated relationships among entities.

In order to make the system persistent, the following issues are considered:

- to store the data in the database,
- to allow a user to access different views of the system, and
- to establish smooth communication between users and the system.

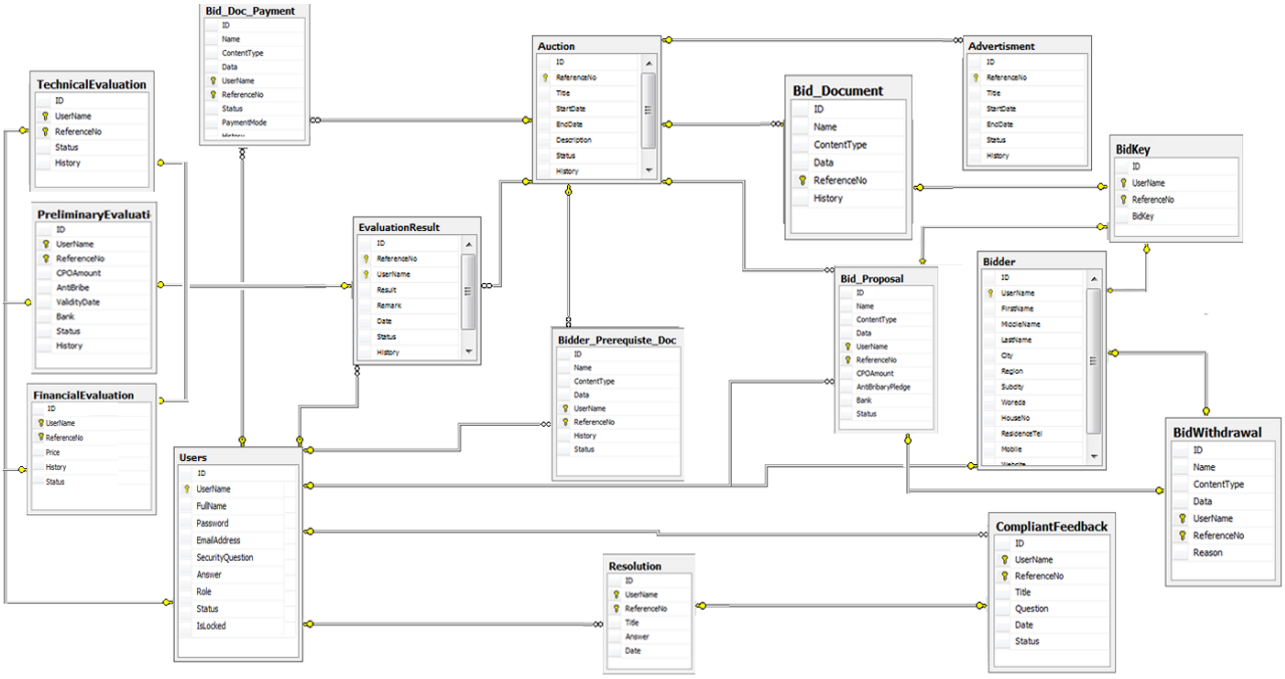

Figure 5: ER diagram depicting entities involved in e-bidding

5.6 Bidding Algorithm

Bid evaluation involves evaluating three main steps/criteria: preliminary, technical, and financial evaluations. The sum of all the three evaluations determines the bidder's ranked position.

The individual scores from each evaluation contribute to the overall score of the whole bid offer. The overall result is the weighted sum of all the evaluation scores. Our algorithm is designed in the spirit of the FDRE Ethiopian public procurement proclamation, its procedures and manual.

6. Implementation

The Active Server Page.Net programming language has been used in this work to develop the system. The backend database technology is MS SQL Server 2008 running on Windows Server 2008 operating environment. In addition, Visual Ge'ez, that supports Ethiopic Unicode, is used for Amharic script. The developed system is capable to show different screens depending on the role of the user. Figure 6 shows the home page of e-bidding in English allowing users to see public bidding information/advertisement, login, get registered, and change language option. Figure 7 shows the same in Amharic language.

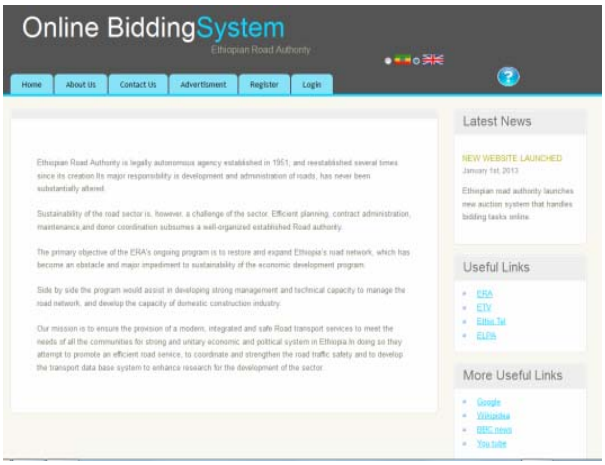

Figure 6: Screenshot of guest user Home page

Figure 7: Screenshot of guest user home page in Amharic

Depending on user privilege, the system provides different views of the system to auctioneers, system administrators, and bidders. Figure 8 allows administrators to maintain system information, generate reports, provide feedback response, etc.

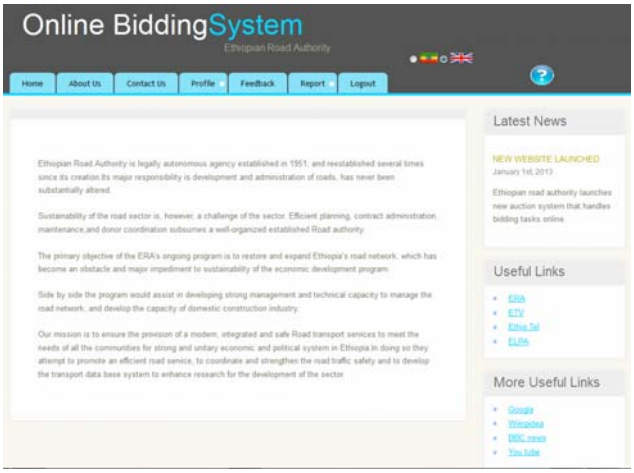

Figure 8: Screenshot of administrator's Home page

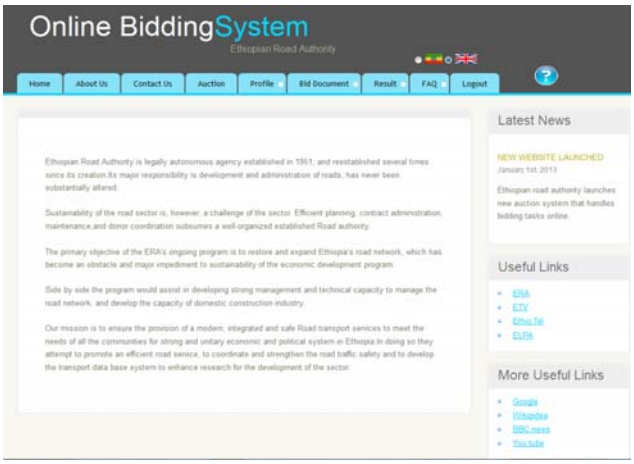

Figure 9: Screenshot of bidder Home page

Figure 9 allows bidder to provide bidding documents, retrieve auction information in addition to public information.

7. Conclusion

This is an initial work on electronic government procurement system in Ethiopia by means of developing a web-based bidding system that supports the bidding activities of public bodies.

To do so, we analyzed the whole procurement process and documented the business logic. We evaluated the role of auctions in public procurement, designed the needed components, and provided a fully functional online bidding system.

The use of this online bidding system can help public bodies to procure more efficiently, and can bring about significant cost and time savings.

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