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Research Article

Automated Contractor Prequalification System in Nigeria

Chinyere I. Akobundu[1*] and Deborah U. Ebem[2]

[1]Computer Science Department, College of Sciences, Evangel University, Akaeze
[2]Computer Science Departments, Faculty of Physical Sciences, University of Nigeria, Nsukka

*Corresponding Author
Chinyere I. Akobundu

Abstract: The issue of awarding projects to the best contractors has been a big challenge in Nigeria, mostly, awarding of contracts are based on sentiments and lowest bidder because there is no regulating system that buttresses qualified contractors automatically, resulting to contracts been removed from a contractor and re-awarded to another due to the lapses seen on the part of the contractor after awarding of contract and the project execution in progress, this has adverse effect on the economy of our country, as time and resources has been wasted and the continue wasting these resources attract negative name to the country. Research has shown that though prequalification system has been in place, the system has not been automated as to have a backup knowledge of existing contractor before time. Contractor prequalification is an information gathering and assessment process that determines a contractor's capability, capacity, resources, management processes, and performance. The existing prequalification system only exists when there is available project and had always been manipulated because it is not automated. Based on the challenges faced due to non-existing automated system, this research has been put in place which harnesses these challenges by building an automated contractor prequalification system. The system has an updated record of all subscribed/registered contractors, the administers makes necessary routine survey to authenticate the information presented during the registration and updates. A simulated automated system of the contractor prequalification system was built using Java programming language and mysql wampserver as the database.

Keywords: Automated, Prequalification, Contractors and Projects.

1. INTRODUCTION

The awarding of contracts to the best qualified contractor for the timely, quality, cost-effective and satisfactory delivery of projects has really been a thing of concern in Nigeria as she has based its contract awarding on best bidder, connection (popularly known as IM) and bribery. Over the past years, the dominant procurement process in the construction industry has been the competitive 'low-bid' procurement process. However, the low-bid process has been unable to produce the required results alone. In fact, the evaluation based on the low price is a critical issue in project delivery (Topcu, Y. I. 2004). This type of evaluation may also end up in low-quality work, claims, litigation, and increased costs for project management (Darvish, M. *et al.*, 2009). The connection between the client and the contractor, who are the two main participants of construction projects (Kog, F., & Yaman, H. 2014a; Kog, F., & Yaman, H. 2014b), needs to be strengthened. The connection process is done to evaluate contractor, project, and contractual risks (Awad, A., & Robinson, F.A. 2011). One potential method to help select qualified contractors is to use a performance-based contractor prequalification process. Prequalification involves contractors being assessed over a range of quality criteria and then being registered for specific types and sizes of work (Sultan, A.T. (2004). Tenders within the construction categories would then specify the minimum prequalification level required enabling a supplier to submit a tender and that supplier would not be required to resubmit information assessed as part of the prequalification.

To avoid manipulation of the prequalification system as information is always resubmitted anytime there is available project for awarding, the researcher initiated the idea of automated contractor prequalification system in Nigeria. Contractor prequalification is an information gathering and assessment process that determines a contractor's

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capability, capacity, resources, management processes, and performance. These can be quantified using predefined factors. Pre-qualification is not an easy task. It is no wonder most companies ignore this step. Getting reliable information is the first challenge, and getting it from the contractor can take a lot of time. More often than not, the information you are provided with will still be unreliable and unverified. But once a system is setup, companies that want to get contracts must subscribe to the system and automatically the system is diagnosed based on the already verified information uploaded in the system and the number of times such companies have been awarded a contract (on the bases of open governance in project management).

Recently the issue of system automation has gone viral: in businesses, education, government sector and other areas. *System automation* is the set of software and hardware that allows computer *systems*, network devices or machines to function without any manual intervention. System automations allow computer *systems* to work without a human operator physically located at the site where the *system* is installed. From the history of Nigeria's project awarding, the issue of automated contractor pre-qualification system has not existed.

Contractors play a significant role in construction projects and selection of the most appropriate contractor for the project is a critical decision for clients. The pre-qualification of construction contractors is accounted as a very important step in contractor selection for every project. The main purpose of pre-qualification is to identify an array of eligible contractors, which is required for post-qualification steps and further considerations. Although there have been numerous models for contractor pre-qualification, there are inadequate researches to present a contractor pre-qualification model with consideration of the project objectives or the project owner's requirements (Amirhosein, J. 2013).

Due to the uncertainty facing most projects awarded to contractors, this could be more prominent if an inappropriate contractor is selected, evidently without arguments will reduce delay, cost overrun, substandard work, dispute, bankruptcy or abandoned projects.

Automated system concept involves the using of computer aided tools for decision making and growth steadily as decision support systems (Khripunova, A. S. *et al.,* 2013). It prompts reliable pre-qualification system acts as a gatekeeper, giving you confidence and peace of mind when you have contractors working on site. It ensures that you are meeting your contractor obligations. When a reliable automated contractor pre-qualification system is set in place, the government and governed can come to terms with democratic nature of the government.

The beauty of a reliable pre-qualification system can never be over emphasized because a reliable automated pre-qualification system ensures that you are meeting your contractor obligations. With a good automated pre-qualification system in place, you should be able to check the following without a problem:

1. Insurance Check:

A good system lets you keep a record of contractor insurance details and alerts you when the insurance details require updating so that you can remind the contractors to update their insurance. This ensures that you don't have contractors with expired insurance cover working on site at any time, as this poses a very expensive risk in case of an incident.

2. Work Cover Registration Check:

After checking and confirming a contractor's work cover registration, a good system allows you to save the information and provides automatic tracking capabilities.

3. HSE Check:

A good system should make it possible to create a questionnaire to determine whether contractors meet all the compliance and pre-qualification requirements

2.0. REVIEW OF RELATED LITERATURE

Prequalification is seen as the joint management value (for contractors and the people awarding the contract) for money initiative aimed at simplifying the sourcing process, reducing tendering costs and encouraging on-going supplier performance. Prequalification involves contractors being assessed over a range of quality criteria and then being registered for specific types and sizes of work. Tenders within the construction categories would then specify the minimum prequalification level required to enable a supplier to submit a tender and that supplier would not be required to resubmit information assessed as part of the prequalification (Auckland Transport. 2012).

The prequalification of contractors is important to ensure the success of construction of projects. Prequalification has been established as a standard practice by public and semipublic organizations. It's objective is to ensure that the contractor's characteristics and capabilities match the requirements of the project under consideration. Effective and objective qualificiation processes serve both owners and contractors (Abdulaziz, A. B., & Kamal, H.A. (1996). After a thorough survey by Abdulaziz and Kamal in Saudi Arabia, they came up with eight (8) common criteria for evaluation in contractor prequalification system, which they noted as: contractor's experience, financial stability, past performance, quality performance, project management capabilities, contractor failure records, management staff availability and contractor capacity. After their

finding, they compared their findings with that of United State and observed that the criteria are similar (Abdulaziz, A. B., & Kamal, H.A. 1996), the system lacked automation which will prompt starting the process of checking the criteria any time there is contract to ward.

One of the most cases of complexity in the construction industry is the selection of the appropriate contractor. (Awadh, S.A., & Robinson F. A. 2011) Awadh presented several mathematical models which is aimed to minimize if not eliminate all aspects of subjectivities that may lead to undesirable results. The model follow the process of the owner of the project setting the criteria required for the project to be conducted and who will further assign weight for each criterion based on how it is important from the owner's point of view. The owner will go ahead and distribute questionnaires among the bidders for prequalifying them. The result at the end reveals the best bidder perfect for the contracts available at that time. His assessment was based on five criteria after the identification of the contractor. The five criteria include: Contractor's performance, contractor's equipment, construction ability, completion ability and client relationship (Awadh, S.A., & Robinson F. A. 2011).

(Amirhosein, J. 2013) Amirhosein in his paper noted that there has been several models developed for contractor's pre-qualification for the essence of extracting the array of eligible contractors, he pointed that though there have been numerous models for contractor pre-qualification, there are inadequate researches to present a contractor pre-qualification model with consideration of the project objectives or the project owner's requirements. He further developed a new contractor pre-qualification model with the aim of resolving this issue. The model employs the quality function deployment (QFD) method, and considers both the project owner's requirements and the contractor's abilities. The results reveal that consideration of the project objectives or the project owner's requirements and expectations can influence contractor pre-qualification.

(Auckland Transport. 2012) Sultan carried out a survey in the year 2004 on the contractor's pre-qualification to identify the perception of the major clients on the importance of the pre-qualification criteria used to qualify contractors in construction industry using Jordan as a case study, his results indicated that public and private clients have different views about the importance and priorities of the pre-qualification criteria. Public clients place more weight on price after the contractor has been qualified. Special pre-qualification criteria are highly needed in Jordanian construction industry to meet the new requirement such as good manufacturing practice.

The interest of most project owners when awarding a contract is to ensure that selection of contractors is based on contractors that can complete projects cost-effectively. The Federal Highway Administration (FHWA) came up with a model showing that one potential method to help select qualified contractors is to use a performance-based contractor prequalification process (U.S. Department of Transportation., & Federal Highway Administration. 2014). The report presented by the FHWA, presents the results which evaluated the benefits and costs of performance bonds and performance-based contractor prequalification, and recommended a model performance-based prequalification approach. In the highway industry, one of the main methods to prequalify a contractor is determine whether or not a performance bond can be secured. The current performance bonding system does not differentiate between a high performing and marginally performing contractor, so long as the two companies have the same level of financial assets. This gives both companies the same opportunity to bid on a project, regardless of performance. In a low-bid environment, it creates a situation where a State transportation department subsidizes marginal performance, which, in turn, reduces the incentive for top performers to continue superior performance (U.S. Department of Transportation., & Federal Highway Administration. 2014).

(Awad, A., & Robinson, F.A. 2011) Awad used fuzzy logic and expert systems to develop a decision support system (DSS) for use in contractor and project evaluation for sole intention of identifying and classifying the most relevant evaluation criteria that surety underwriters and brokers consider when evaluating a specific construction project for bonding purposes, which scored high in efficiency in terms of criteria identification and classification but still can be recycled for further usage.

Faikcan *et al.*, proposed a multi agent systems (MAS) based contractor prequalification model which will support clients decision with the optimal solution in a contractor selection phase, he developed the prototype of three tendering processes which are open, selective limited and negotiated (Awad, A., & Robinson, F.A. 2011).

3.0 METHODOLOGY AND ARCHITECTURE

The method used in analyzing this work is Object Oriented Analysis and Design (OOAD). Object Oriented Analysis (OOAD) is a Model-driven technique that integrates data and process concerns into constructs called objects. OOAD models are pictures that illustrate the system's objects from various perspectives such as structure and behavior.

3.1 USE CASE DIAGRAM

A Use Case illustrates a unit of functionality provided by the system. The main purpose of the Use-Case diagram is to help development teams visualize the function of the system including the relationship of the "ACTORS" to essential processes, as well as the relationships among different use case. Contractor pre-qualification system involves majorly five actors which includes: government, privates, system admin, contractors and

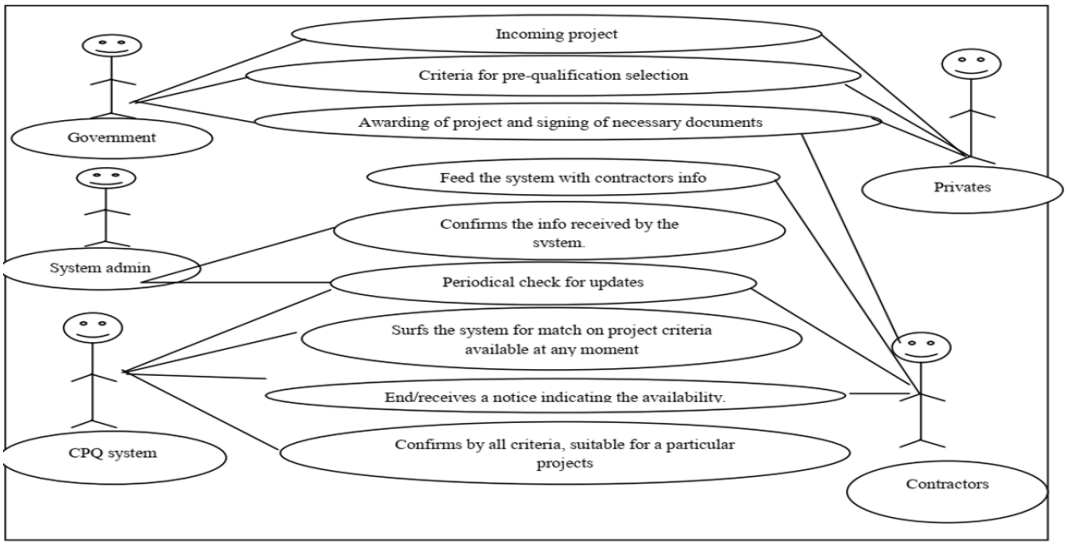

Figure 1: Use Case Diagram Of Contractor Prequalification System

3.2 STATE CHART DIAGRAM

State chart diagrams attributes are represented by rounded rectangles labeled with their names and the transition which is labeled with arrows connecting states. A state is a condition of an object in which it performs some activity or waits for an event. While a transition is a relationship between two state which is triggered by some event, meant to performs certain actions.

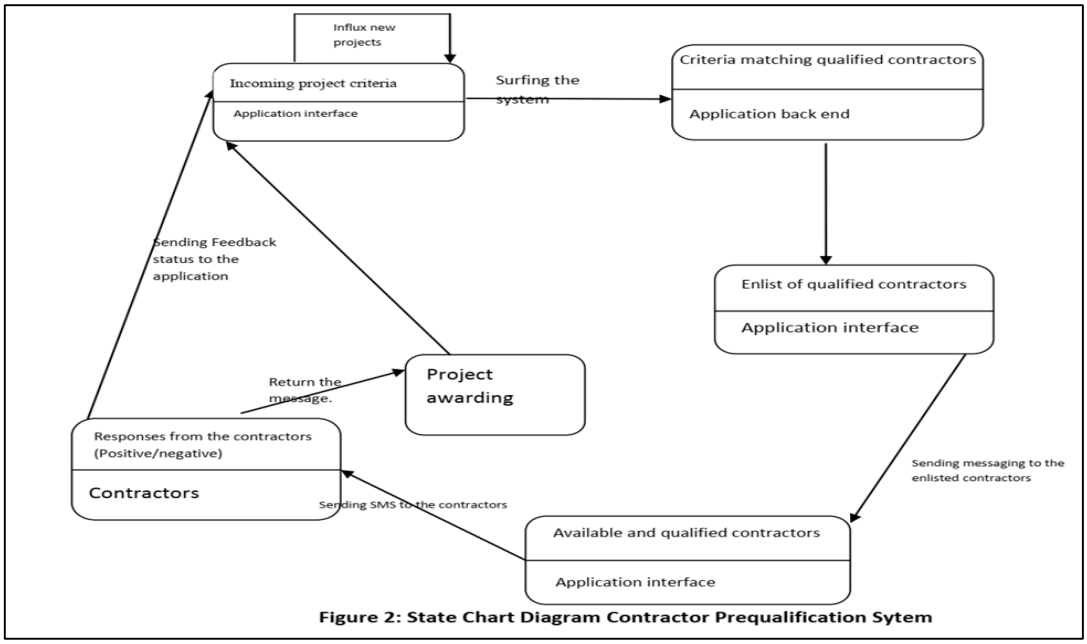

Figure 2: State Chart Diagram Contractor Prequalification Sytem

3.3 ARCHITECTURE OF THE PROPOS SYSTEM

The proposed prequalification system is designed to show transparency in contractor awarding applicable for both public and private contracts, where the most qualified and available contractor is been awarded the contract. The system automatically matches the qualified contractors based the criteria for the project provided by the owner of the project to be contracted. Figure 1 below shows the architecture of the proposed system.

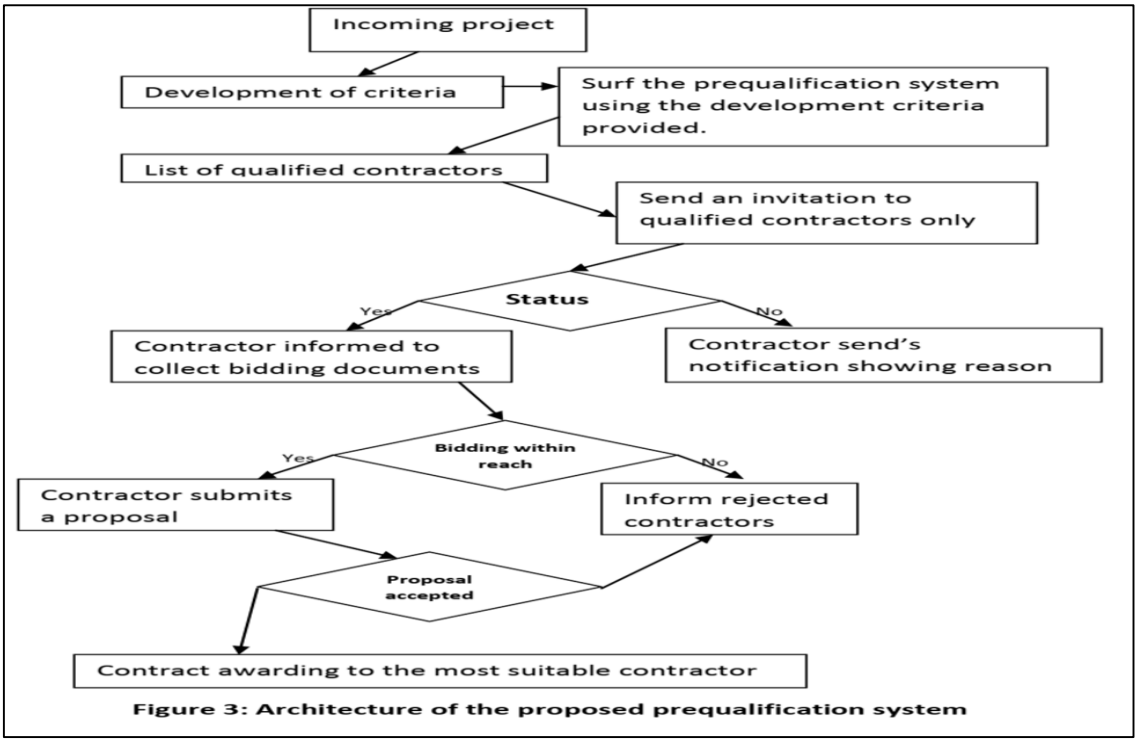

Figure 3: Architecture of the proposed prequalification system

4.0 RESULTS/SOFTWARE IMPLEMENTATION DETAILS

The section shows the implementation pseudocode and the software implementation of Contractor Prequalification System

4.1: CONTRACTOR PREQUALIFICATION INTERFACE

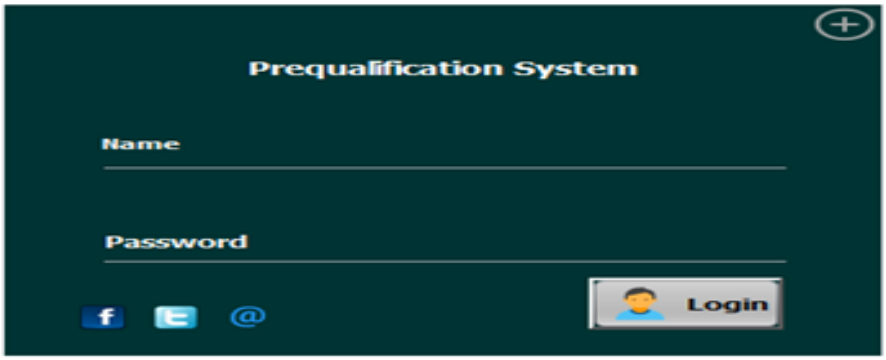

Figure 4: Login page

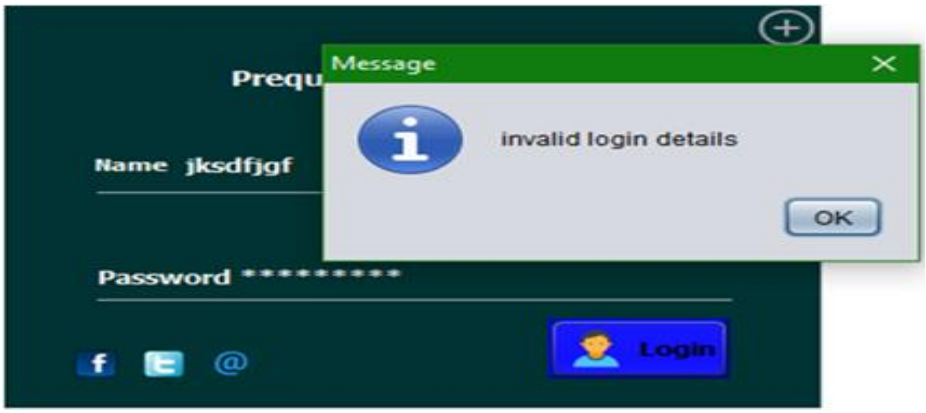

Figure 5: Login with incorrect login details

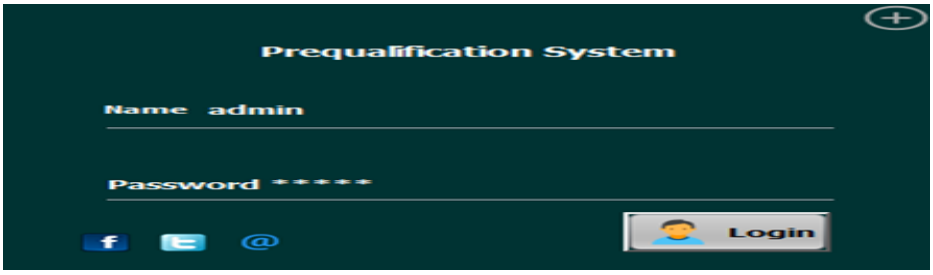

Figure 6: Login with a correct login details

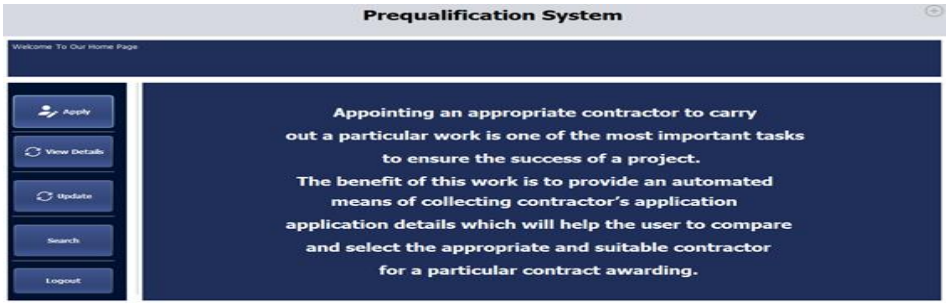

Figure 7: Home page

Figure 8: Contract Application Form

Figure 9: Contract Form Filled

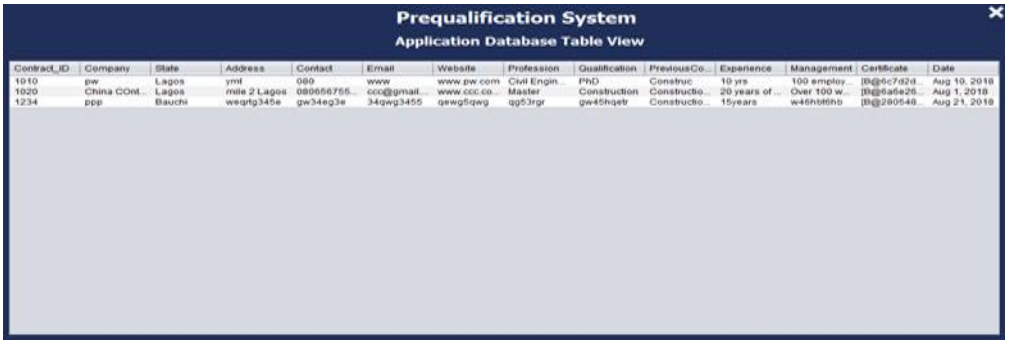

Figure 10: Database view

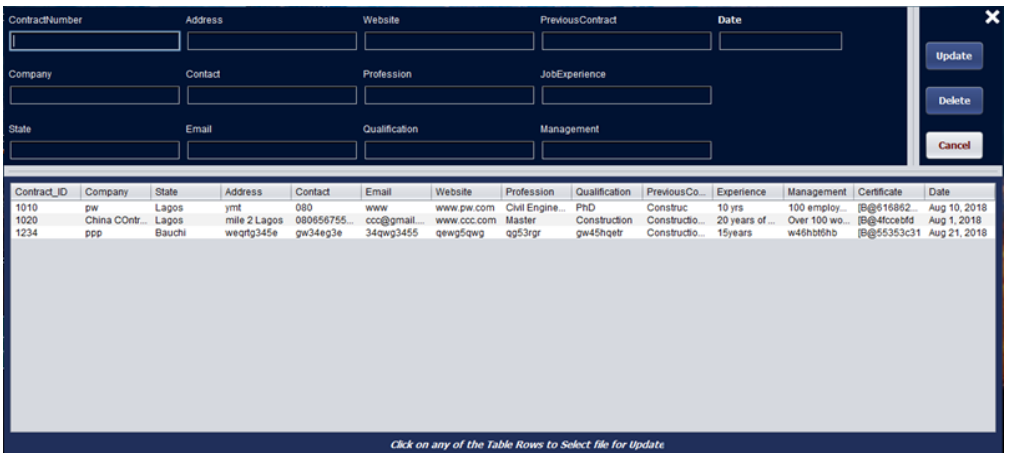

Figure 11: Contractor's Details update form

Figure 12: Contractor's Details update form with data

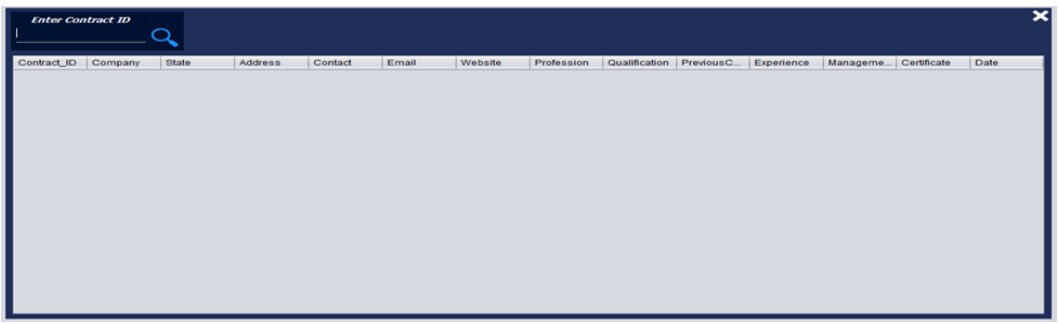

Figure 13: Application details retrieving page

Figures 4 to 13 display the interface of the implementing software of the contractors' prequalification where the data of all interested contractors who which to get contracts from both public

sector and privates are collated, it is opened to update because experience and some other factors are not static rather dynamic. When there is need for awarding a contract, the system is surfed using the criteria specified by the owner of the contract, the list of qualified contractors for that particular project would be listed and automatic message sent to all the listed contractors, who uses a predefined code to specify if available for the contract or not, the system on receiving the response, sends a message awarding each contractors bidding and proposal for awarding the contract.

4.2 DATABASE DESIGN

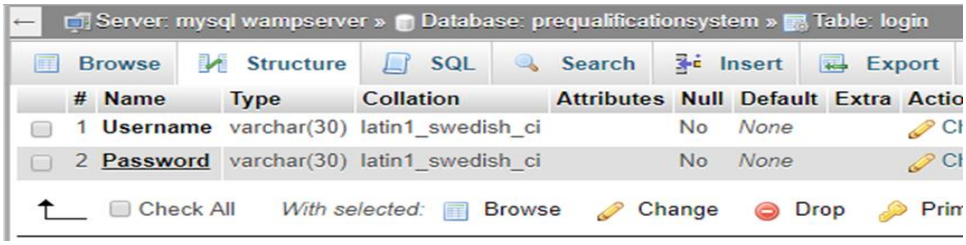

Figure 14: Login table structure

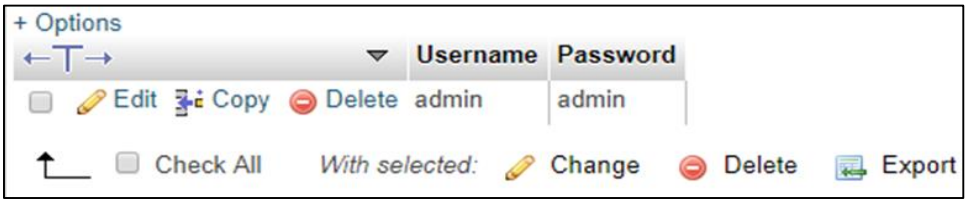

Figure 15: Login table with values

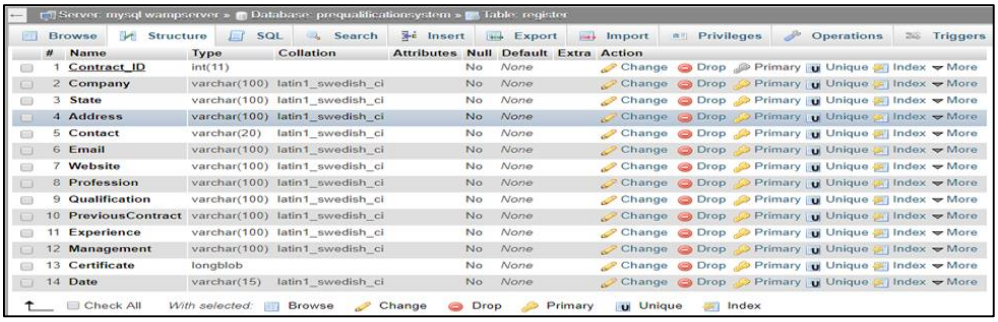

Figure 16: Contractors' application table structure

Figure 17: Application table with records

Figure 14 to 17 show the database design of the contractors' prequalification system.

4.3 ALGORITHM FOR THE AUTOMATED CONTRACTOR PREQUALIFICATION SYSTEM

1. Start
2. Login authentication /enter the authentication requirement(s)
3. Successful
4. Company subscription
5. No GOTO 20
6. Yes
7. Contraction Company Subscription completed
8. No GOTO 4
9. Yes
10. Check projects available and company status
11. If status for project "qualified"

12. Send bidding requirement
13. Else
14. Send query "Query"
15. Project awarded
16. Sign the necessary paper(s)
17. Start time recorded
18. Project process monitored
19. Project completed
20. Stop.

5.0 CONCLUSION

The importance of automating contractor prequalification system can never be overemphasised because the system has been built to ensure the selection of a suitable and qualified contractors to carry out the available projects with automated record tracking system. The essence of setting such system in place is for the normal system of lowest bidder without quality and sentiments on awarding the contracts be reduced to minimal, if not eradicated. When government adopts the system and it is implemented fully, and it is adhered by the public and privates and private contract owners, builting of quality works will be guranteed and on the other hand, those contractors with low reputation will work hard to improve. Most of the contractors that will get a contract and use fake materials that will not last as antipated by the project owner will be expose, and using the prequalification system, those contractors will not get contractors as long as they continue with such act. The system collects information by the contractors, and also the system is updated by the information gathered by the managers of the system who go out periodically to gather information concerning each contractor that has been registered, all will be used to assess them when there is availability of project(s) for awarding.

It is strongly recommended that the government accepts this idea of using the contractor's prequlification system as a gateway to getting any kind of contracts in Nigeria, with which the issue of sentiments and low bidder which has obviously done more harm than good will be a history, and generally Nigeria will make a good name globally in terms of quality project completion and reputation which will inturn have positive effect on our economy growth.

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