Pata Services: a mobile application for professional home maintenance services

Joy M. Mwende,[1] Danny Nyatuka[1]*

[1]Faculty of Information Technology, Strathmore University, Nairobi, Kenya

** joy.muoti@strathmore.edu*

Abstract

In the past few decades, there has been population increase thus leading to high demand for housing especially in urban areas. This situation has created opportunities for the private sector with massive investments in the real estate business. However, there has been lack of proper inspection of such projects in some cases. Therefore, regular checks and maintenance particularly of residential buildings is needed to ensure the safety of tenants. However, it's often a difficult task for to identify qualified home maintenance service providers such as plumbers, electricians and painters among others.

As a result, unqualified persons are engaged to fix such problems, which eventually turn out to be disastrous including collapse of buildings, electrocution and leakages from water pipes and sewage. Apparently, there are no proper tools to provide information on where to find professional home maintenance services. The proposed project will develop a mobile application to enable tenants to identify and hire qualified service providers who must be registered and certified by relevant authorities. The project will use extreme programming model where Android studio will be the platform. Firebase will be the database, Java and XML are the languages to be used during implementation.

***Keywords**: Mobile applications, building design and construction, home maintenance, service providers, construction industry, shortage of skilled labour.*

Background

Housekeeping is an ongoing process especially when it comes to the management of households. Many households face different home maintenance challenges that can't be easily fixed due to lack of experience in particular type of problem(s). The maintenance and management of facilities has a great impact on the lifespan of a building. According to [13], the art of maintenance is repair, replacement and changing the tools used in construction.

After the construction of a building is 95% of the buildings' lifespan. A research conducted by Danny Nyatuka [10] states that it is unrealistic to do away with old buildings, but the owners should consider repairing, having frequent inspections and also maintain the buildings.

According to [7], building maintenance has a couple of set objectives which include repair, replacement, modification, protection of basic materials (external painting), decorations (painting), cleaning etc. Some of these challenges can be recurrent or onetime.

Figure 1 is a graphical representation of difficulties experienced in cleaning, inspection, repairing and replacement during maintenance.

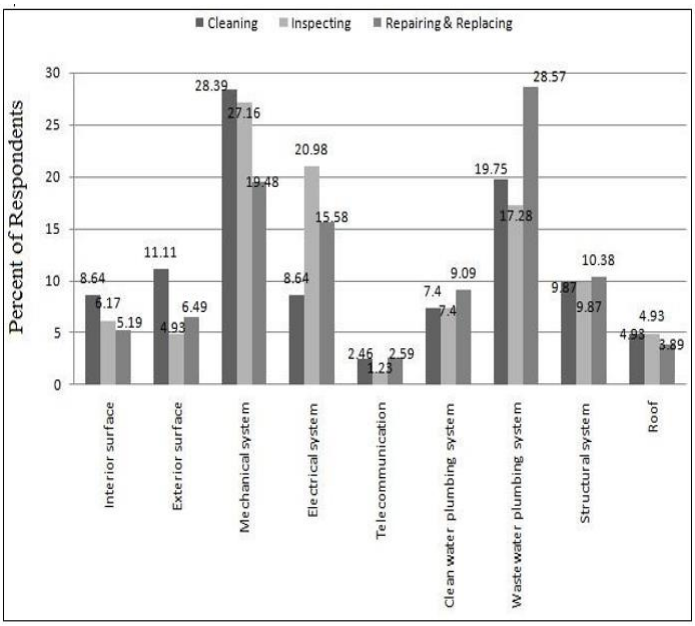

Figure 3: Difficulty of cleaning, inspecting, repairing and replacing building components.

[10], argues that if frequent maintenance is not properly carried out, buildings will depreciate which will increase the cost of maintenance. The construction project of a building has four stages namely: design, construction, operation and maintenance where maintenance helps in the efficiency of using the building. Examples of these challenges include plumbing, electrical, painting, housekeeping and mechanical problems among others. This is a big issue especially when one has moved to an entirely different location thus difficult to access some of these services. For instance, looking for a plumber and or other service providers can be quite challenging as one has to go to hardware shops or ask friends or even neighbours while seeking these services.

Some of the electrical challenges faced are wiring indoor or outdoor and changing switches or even lighting. If one is not careful when handling such problems, there will be a risk of getting electrocuted. A client might want to repaint their house, but they need a professional who will do the work to their satisfaction however, this becomes a problem when one wants to find a professional painter. Plumbing problems that people encounter include clogged drains, replacing faucets and sinks [3]. The ever-increasing population in Kenya has led to thriving demand of housing which has created opportunities for the private sectors who engage in real estate business. Some of them opt to construct low cost houses which might not be of the required standard as their target market is the middle-income earners [6].

With the increased demand for housing and corruption, constructors build poor quality houses and buildings which are faulty. Water scarcity, contamination, and sewage leakage are major plumbing problems faced thus a health hazard. These plumbing problems are mainly

caused by corrosion of pipes, poor building designs and lack of regular maintenance checkups. Therefore, there is need for a tool to help landlords and tenants identify and request for professional home maintenance services whenever one needed the service. Success of this project will help save lives by ensuring that only professional home maintenance service providers are engaged.

It will also help save time and costs that would be incurred by tenants while looking for services since one can do it from home. Also, this will reduce the cost of maintaining buildings as well as avoiding losses through collapsing or demolition of buildings. The aim of this project is to develop a mobile application that can facilitate access to quality and affordable home maintenance services by tenants.

Table 1 shows employment qualification of craftsmen according to a study conducted in Edo State Nigeria.

Table 1: Employment Qualification of Crafts men/trade

Description	Frequency	Percent
No response	1	1.1
Primary school plus apprenticeship	53	59.6
Modern school plus apprenticeship	5	5.6
Secondary school plus apprenticeship	18	20.2
Technical school graduate	12	13.5
Total	89	100.0

Table 1 shows employment qualifications of crafts men/trades. 59.6% of the respondents holds primary school certificates plus apprenticeship, 5.6% of the respondents holds modern school certificates plus apprenticeship while 20.2% of the respondents holds senior secondary school certificates plus apprenticeship and 13.5% were technical school graduates.

According to the study a bigger percentage of craftsmen held primary school certificates thus have little capacity to understand, take instruction from supervisors which imply that that the construction industry is dominated by unskilled/unprofessional service providers.

Overview

This chapter aims on reviewing the existing literature on the current home maintenance systems. It aims at doing an analysis on the current situation in the construction, housing and sanitation sector, problems identified and also the solutions proposed.

Current situation in Kenya

The construction industry in Kenya is at its peak as the government has invested in the improvement of infrastructure which includes construction of roads and railways which has given rise to residential homes and businesses. There has been an increase in population which leads to a high demand for housing which creates opportunities in the construction of residential, profit-oriented and industrial buildings. Immense opportunities now exist for

investments to upgrade slums, slum renewal, middle and low-income housing. According to [6] the construction sector faces some challenges which include quality assurance, corruption in obtaining contractors, unskilled labour, health and safety challenges etc.

Challenges faced

One of the major challenges faced in the construction of a building is quality assurance. The collapsing of buildings has been a menace to the country as there is lack of capacity to expedite developments and ensure that they are up to standard. A report done by [11], the health officers do not carry out thorough checks on the buildings.

Statistics show that 51 out of 640 buildings in Nairobi have agreed to be inspected, the materials to be used to be of quality and the building tested [9]. Use of unskilled labour is also a major problem when it comes to the construction of buildings in Kenya. This is a major issue when it comes to the construction of low housing units (especially flats), which leads to the collapse of buildings thus endangering lives through waterborne diseases.

According to [1] only the accredited and licensed workers should work and supervise at the construction sites. The use of unskilled labor leads to poor work done which may have fatal outcomes in the long run. Corruption is also a hindrance when it comes to the awarding of tenders.

This takes place when a procurement officer gets bribes to allocate a certain project to someone who may not be well qualified for a job at hand. This is a serious issue as the person given the project might not be so keen in the development of the project which may lead to poor buildings.

Factors leading to the use of unprofessional services

A study by [12] reveals that there has been a shortage of skilled labor in the construction sector which might have resulted due to a number of factors including lack of training, an aging workforce, poor image of the workers and the fact that the industry does not appeal to many youths who prefer white collar jobs.

In addition, the use of technology lead to lack of physical skills, self-employment where the craftsmen are not able to improve their qualifications whereas the industry is not popular because of the image it portrays for a career choice. In case a client needed a particular maintenance service, they prefer craftsmen who are not well trained to help them out.

Table 2 represents factors causing shortage of skilled of labor shortage in the construction industry.

Table 2: Mean Response Analysis for causes of skilled labor shortage.

		MRA	Rank
q16i	No clear-cut career path	2.83	1
q16d	High mobility of construction workers	2.69	2
q16h	Low wages	2.67	3
q16j	Diminishing craftsperson training programme	2.61	4
q16b	Growth of self-employment	2.58	5
q16e	Dissatisfaction with labor organization	2.53	6
q16a	Introduction of new technologies	2.47	7
q16g	Ethnic characterization	2.44	8
q16f	Poor safety of construction work	2.31	9
q16c	Poor image of the industry	2.03	10

Table 2 shows the result of the mean response analysis that was conducted for the identified causes of skilled labor shortage in the construction industry.

Problems arising

Plumbing does not only involve installation of pipes, but it deals with the design structures of a building. If a building is poorly constructed it can cause contamination, energy wastage and even health issues to the inhabitants. Areas with high population densities like urban areas and slums face problems like waterborne diseases mainly because of contamination caused by poor plumbing systems.

Studies show that corrosion, contamination due to sewage, leakage and scarcity of water lead to serious recurrent cases of Legionella [2]. Studies show that contamination is mainly caused by corrosion and wearing off of metallic pipes. Corrosion aids in bacterial growth which leads to water contamination.

Plumbing defects can cause economic loss if the problem has been ongoing for a period of time for instance in the case of consumption of hot water. If the design is not good a lot of energy is wasted due to the length of the pipes.

The performance of a system becomes generally slow maybe due to blockages of the sewage: this can be caused by overloading of the pipes using solid wastes. A plumbing hitch can deteriorate the built environment this can be as a result of lack of clean air leading to putrid air being discharged from the vents into a building.

Existing maintenance information services

The government of Kenya has set laws under the National Construction Authority constituted under Act 41 of 2011 which states that the constructors should be accredited and registered before they undertake any construction activities which is not the case. There is an online portal where people can register, go for trainings and get their licenses.

If anyone needs a certified contractor, they can acquire it from [www.nca.go.ke.](http://www.nca.go.ke) In as much as there is a website where one can get a contractor, most people opt for unskilled services mainly because they are cheap not realizing that cheap is expensive.

The online portal provides a range of services which include finding a contractor, artisan training, tenders etc. The website allows one to register, view contractors and also request for a contractor.

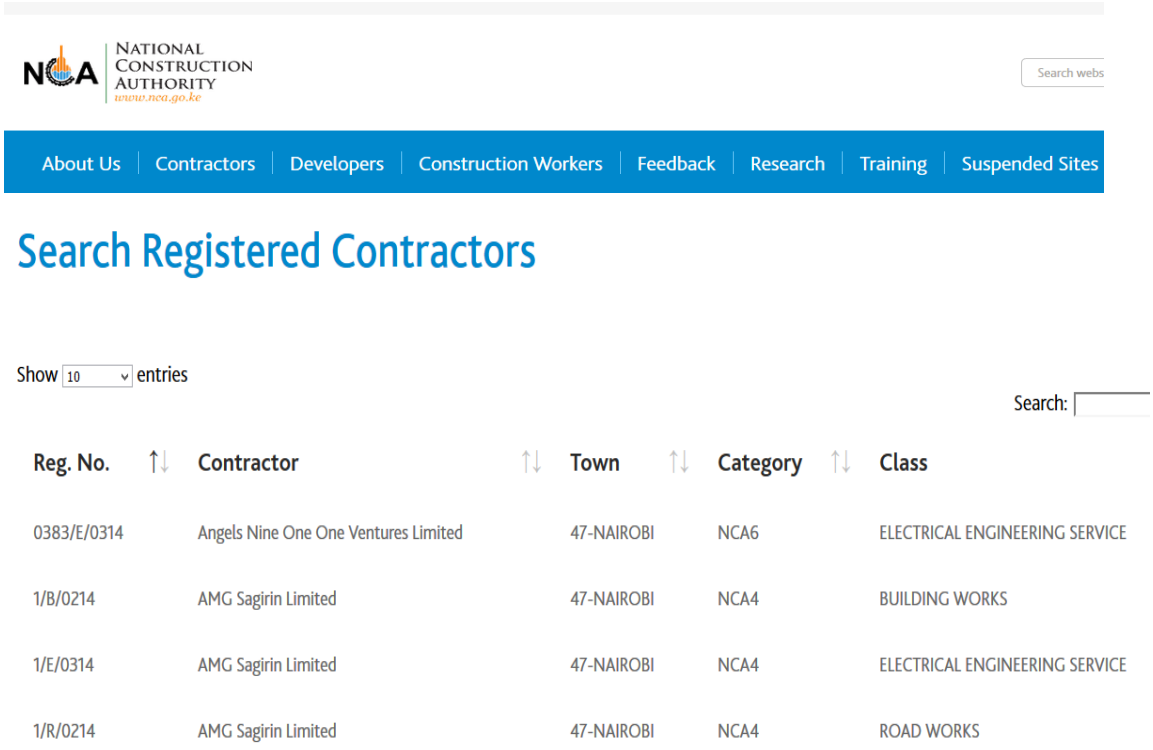

Figure 4: National Construction website

According to [16], some of the major gaps in existing web platforms involves poor communication as users can only interact with the servers but in most cases, there are coordination issues which can make a user's interaction cumbersome.

The proposed project considers swift communication between the clients and the service providers by simply giving the clients the option of communicating directly to the persons who can offer the services one would be interested in. The current web application does not allow the clients to rate the service providers after receiving the service, which is a gap, the proposed system will address.

Additional fields have been designed and added to the original Revit Building Information Model to accommodate the required maintenance of data. Additional fields are part of the developed system; therefore, once the BIM module is uploaded within the system, these fields will be populated automatically in the BIM application.

However, users will have to fill in these fields in order to identify the maintenance case. On the contrary, the proposed system does not require any additional field as part of the

maintenance. Once you request for a service and its delivered, all you do is rank the service provider according to the level of prowess shown in service delivery.

Operation of proposed system

When the maintenance team gets a new maintenance problem and needs to search the system library for any similar cases, the system interface allows users to describe the new case, for this example it was by writing this statement “window leaking problem in the building”. In addition to the description, the system will use the default weights assigned to the case attributes. The users are allowed to modify these weights, to best represent his/her assessment on these attributes. The system then starts searching the Case Based Reasoning library, retrieves all similar cases, and ranks them according to the similarity index. Instead of ranking problems as illustrated above, the proposed system is meant to advocate for fast embark upon by finding the nearest service provider.

Once the issues have been resolved, the service provider is ranked depending on the service offered. This helps break down the issue of users weighing their problems and thus have a one-time solution. Once ranking is, then other users can be able to gauge the kind of service expected as seen in the service providers’ ratings for the purpose of ensuring quality services rendered.

System design and construction

Use Case Diagram

A use case diagram is a methodology used in system analysis to identify and organize system requirements. It is a representation of a user’s interaction with the system. It contains actors and use cases. Actors represent roles played by the system’s users in this case the clients and service providers.

1. Description – Create account
2. Actors – Clients
    a. Pre-condition – User is logged in
    b. Main success scenarios:
        i. The user has created an account using their email and password.
        ii. Description – Request service and service provider.
3. Actors - clients
    a. Precondition – user is logged in
    b. Main success scenario
        i. The user is logged in
        ii. The user selects a service, service provider and rates them.
4. Actors – Clients
    a. Pre-condition – user is logged in and has selected the preferred service.
    b. Post condition – the user has selected the service provider
5. Actors – service providers
    a. Pre-condition – create account

b. Main success scenarios
    i. The user is logged in
    ii. The user can create and update their profile

The user has provided information such as name, service, phone number, service pin and email address.

The user decides to create a profile. The system checks whether the information provided is correct.

Alternative flows

1a. if the data input is incorrect e.g.

IF: the user inputs a wrong password while trying to log in after creating an account.

THEN: prompts “Please input the correct password”

2a. The user does not select a service provider the system will assign the service provider closest to the client.

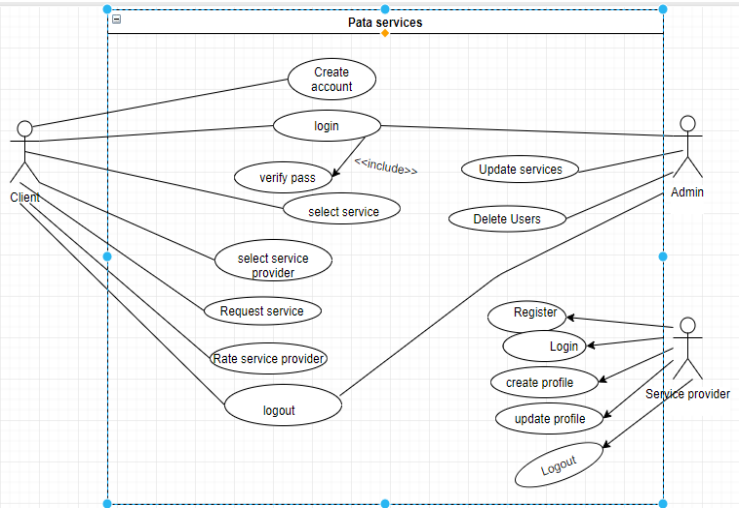

Figure 4: Use case diagram

Sequence Diagram

This is a diagram that graphically shows how objects interact with each other through sending messages in the execution of a process. In this case once a user logs in, the application validates the user’s credentials and either accepts or rejects the login.

The user then choses the service that they require, and the service provider closest to them. After the service is rendered the client will be able to rate the service providers in a scale of 1-5 where 1 is poor and 5 being excellent.

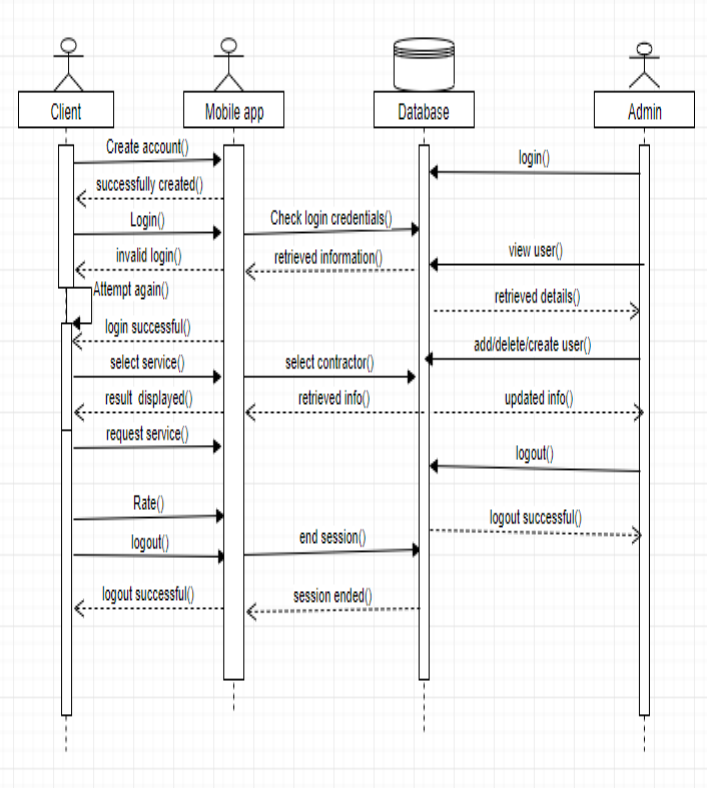

Figure 5: Sequence diagram

Flowchart

The client creates an account by using an email and password. They have to login where the system validates their information and if not correct, they have to repeat the login process. If successful, they can now choose the service they want. The system will get their current location by use of the map which will help them locate service providers who are nearest to them. Afterwards, they can confirm the request and logout. In order for one to rate the service provider they have to login.

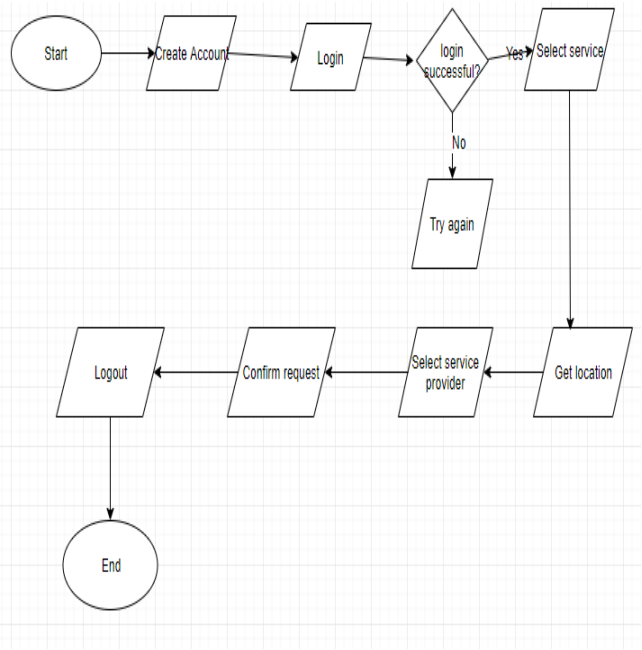

Figure 6: Flow chart

System Architecture

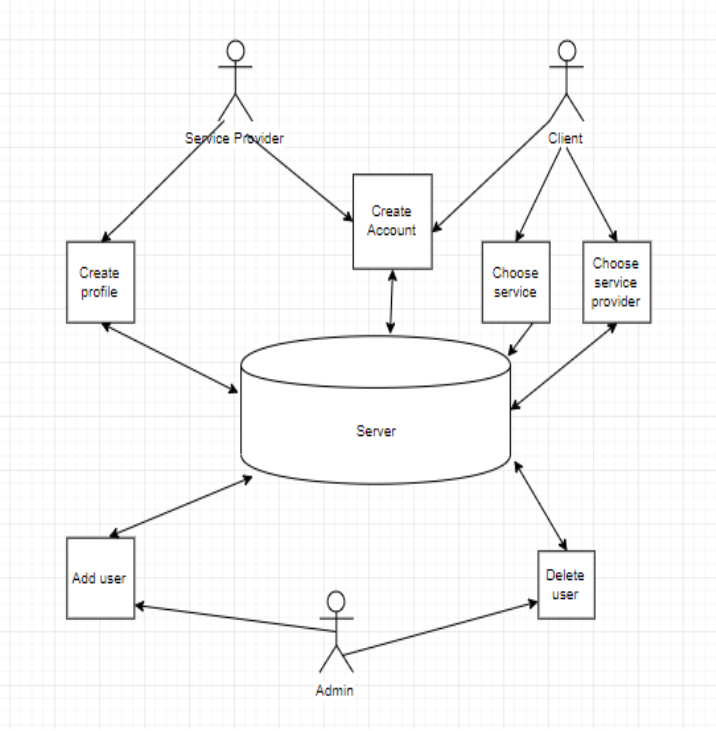

Figure 7: System architecture

As a service provider and a client, creating a new account is mandatory. Moreover, the service provider has the privilege of creating a profile where they update the kind of services they offer. These services can be accessed by a client who is need of resolving a problem.

Therefore, the client can choose the service of desired preference and more so choose the service provider contingent on the rates given.

The administrator can add or delete users. There are new users who whose verification needs be to be done by the administrator. In case of dormant users in the system, the administrator also has the ability delete.

System Development

System methodology is the frame of reference used to design, plan and also regulate the development process of an information system. Extreme programming under Agile methodology will be used. This methodology helps with dealing with shortcomings (Johnson, 2005) as it is involved in creativity, learn and advance through trials and errors etc. XP is mostly based on values such as simplicity and courage while it is very efficient, flexible and is also foreseeable. The flexibility of XP is brought about by the altering of the initial design, frequently testing of codes and also reducing problems at the early stages. Some of the advantages of using XP are that schedules are achievable even though there are time limits, changes can be made and accommodated at any stage [15]. The main disadvantage of XP is that a lot of focus is on the code rather than the design which might bring complications for the software.

System specification

The system can be installed in android devices which should be mobile devices. It will be compatible with devices with android version 4.2.2 which is Jellybean up to android version 8 Oreo.

Java and XML are the programming language that will be used in the development. XML is a markup which is designed to concealing document in a human-readable and machine-readable. Android studio is the platform that will be used. Firebase will be the database for the application.

Acknowledgments

My earnest and deepest gratitude goes to God for His favor and guidance throughout this entire program.

I am grateful to my supervisor Mr. Danny Nyatuka for his invaluable guidance and keen supervision that led to the completion of this project. Finally, I would like to thank my family for their support and encouragement throughout this program.

References

[1] Authority, N. C. (2011). National Construction Authority. Nairobi.

[2] Elvitigalage Dona, N. A. (2008). Women's career advancement and training. In E. Dona, Grading maintainability parameters for sanitary- (pp. 912-931).

[3] Hignell, C. (1948). Maintenance & Construction for your Home and Business: www.hignell.com

[4] Johnson, E. (2005). Agile modeling, agile software development and extreme programing. Idea group.

[5] Kiganda, A. (2016, 9 13). Construction of low cost houses booms in Kenyan city of Mombasa. Retrieved from Construction Review Onlinee: constructionreviewonline.com.

[6] Kiganda, A. (2016, Oct 19). Kenya's Construction Industry and its Challenges. Retrieved from Construction Review Online : constructionreviewonline.com

[7] Lee, R. (1987) Building Maintenance Management. London: William Collins Sons & Co.Ltd.

[8] Nation, D. (2015, sept 9). Car clinic. Retrieved from Why is it so hard to find a good mechanic: www.nation.co.ke

[9] Nation, D. (2017, August 14). what is to blame for the collapse of buildings. Retrieved from MOSE: www.nation.co.ke

[10] Nima A, Mohamed N, et al. (2012). A Survey on the Implementation of Facilities Maintenance Management System of Building in Iran.

[11] Ombudsman. (2015). THE HURUMA TRAGEDY. Nairobi: Office of the ombudsman.

[12] Oseghale, B.O.; Dr Abiola-Falemu, J.O.; Oseghale, G.E. (2015). An Evaluation of Skilled Labour shortage in selected construction firms in Edo state, Nigeria: American Journal of Engineering Research, 1: 156 - 167.

[13] Thuita, P. (2017, January 30). construction Kenya. Retrieved from why buildings collapse so frequently in Kenya: www.constructionkenya.com

[14] Tutorialspoint. (2016). Extreme Programming . Retrieved from Extreme Programming - Introduction: www.tutorialspoint.com

[15] Vanier, D.J. (2001) Why industry needs asset management tools. Journal of Computing in Civil Engineering, 15: 35-43.

[16] Weiming Shen, Q. H. (2008). System Integration and Collaboration in Construction: A Review. Retrieved fromhttps://ieeexplore.ieee.org/iel5/4530852/4536938/04536948.pdf.