

# Design of Web-Based Customer Relation Management Application for Power Distribution Company: A Case Study of PHCN Owerri Business Unit

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## Abstract

*In this paper, the design of web-based customer care application for power distribution company is presented with Power Holding Company of Nigeria (PHCN) Owerri business unit as the case study. The system is developed to address the problems of poor customer services experienced due to the manual approach that has been used by PHCN. The system provided web-based volunteered information system for capturing, sorting and disseminating customers' information, as well as for attending to customers' complaints and bill payments. Furthermore, a mapping functionality is included to enable the system to capture and process spatial information of the customers and PHCN facilities. A modified waterfall methodology is adopted in the web application development. The activities involve in the modified waterfall model includes requirement engineering, planning, designing, coding, testing integration and deployment. The web application is implemented using PHP as the server side scripting language, Java for the client side scripting language, MYSQL for the database management system and it is hosted locally using Apache web server. Equally, a third party web map application is interfaced based on Google map application program interface (API version 3). Sample data are used to demonstrate the effectiveness of the customer care and customer cum facility mapping system.*

**Keywords:** Waterfall Methodology; Web Application; Customer Relationship Management; Volunteered Information System; Database, Scripting Language; Map Application Program Interface.

## 1. Introduction

According to experts, for any service rendering institution, there is need to deliver adequate customer-centric service [1, 2, 3, 4, 5, 6, 7]. In addition, nowadays, there is need for a platform where the service rendering institution can access first hand feedback from their customers [8, 9, 10]. According to Turban et al [11], "customer service is a series of activities designed to enhance the level of customer satisfaction;

that is, the feeling that a product or service has met the customer's expectation or needs" [11]. Evidently, the advent of information and communication technology has encouraged a tremendous drift from the manual customer care service rendered by most companies to e-customer care service. This has improved the ease with which companies access and respond to complaints from their customers especially those from remote locations. Furthermore, the proliferation of geographic information system (GIS) has helped organizations provide more efficient e-customer care service. A GIS is a computer-based system that helps to efficiently model, capture, store, manipulate, query, retrieve analyses, and visualize information where-parts of the information are spatial coordinates [12, 13, 14].

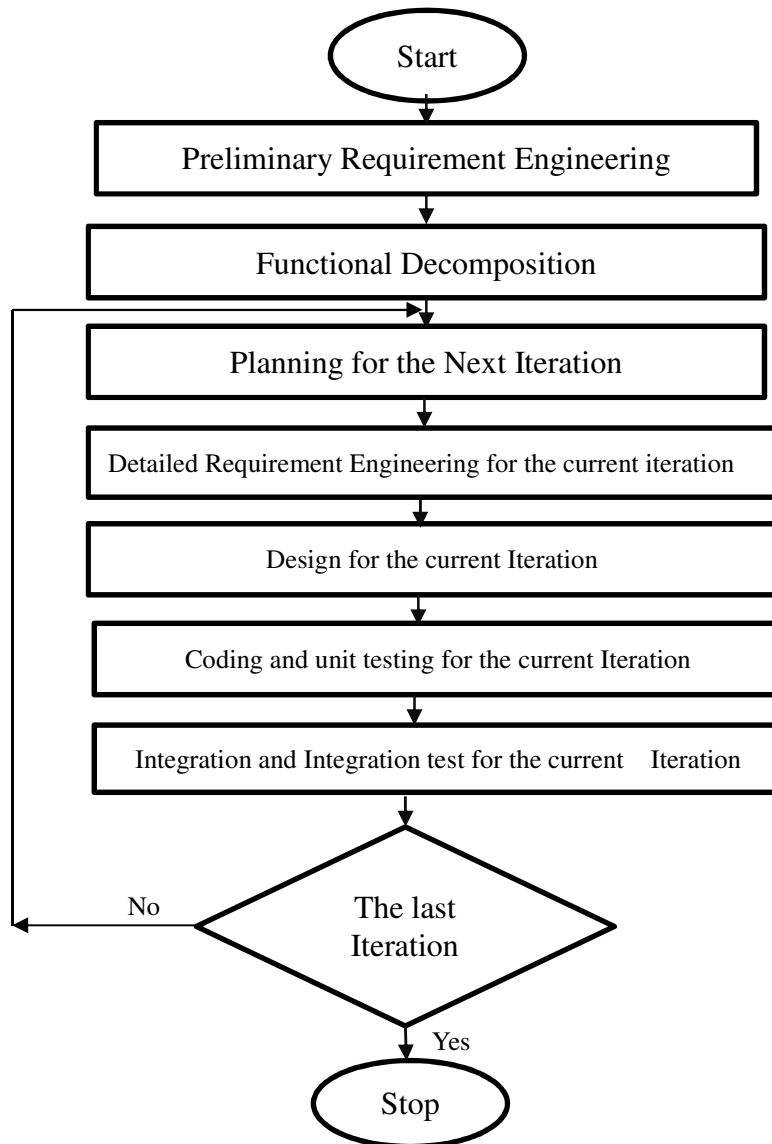
Over the years, the Power Holding Company of Nigeria (PHCN) has been operating manual customer care services [15, 16]. The manual approach has posed numerous challenges. Particularly, it lacks a web based platform where PHCN customers can lay their complaints from remote locations without visiting PHCN offices. Also, with the manual approach, it is not possible for staff of PHCN to use map to visualize the distribution of the PHCN facilities and customers. Facility maintenance becomes difficult due to lack of a platform where customers can promptly relay information should there be a case of facility breakdown.

In this paper, a web-based customer relationship management services for Power Holding Company of Nigeria (PHCN) is presented. The web application is meant to help PHCN to improve on the quality of service delivered to the customers and also to promote timely maintenance of PHCN facilities such as transformer, electric pole, etc. The web application will also handle e-payment of electricity bill. Finally, the system provides an online map platform where PHCN can visualize on Google base map the location of their customers in different business units, as well as, the facilities assigned to each business unit.

## **2. Methods**

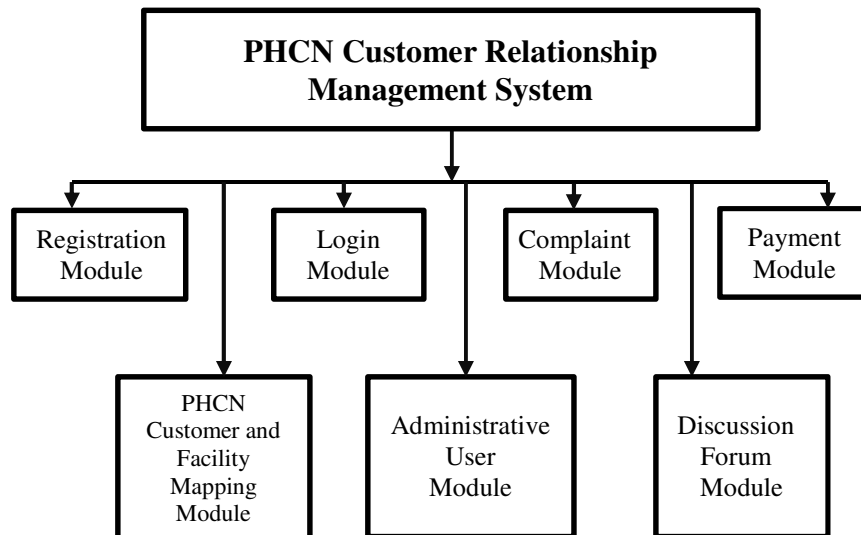
An iterative methodology of Figure 2.1 is used in the development of the web application. The methodology begins with preliminary requirement engineering followed by functional decomposition of Figure 2.2. In the functional decomposition, the web application is broken down into its seven different major functional units. According to the iterative methodology, each of the functional units is selected (during the planning phase); further requirement engineering tasks such as requirement elicitation and analysis are performed and then the functional unit is designed, coded, tested and then integrated into the main software system. The procedure is repeated until all the functional units are implemented.

According to the system management policy, every user must register before login. The flowchart for the registration module and login module are shown in Figure 2.3 and Figure 2.4 respectively.

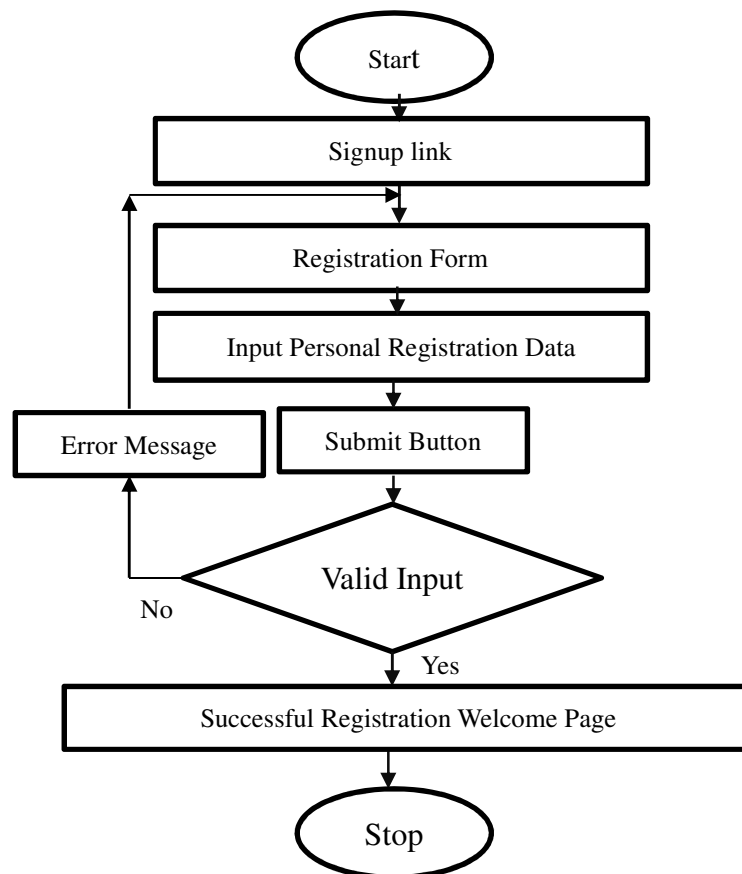


**Figure 2.1:** The Iterative System Development Methodology

When a customer registers, the customer's user privileges are assigned. When the customer logs in, the system redirects the customer to the customer homepage. At the customer homepage, there is access to the following system functionalities, as shown in figure 2.2; complaint, PHCN facility mapping, discussion forum and payment. The diagram showing the features of the customer complaint module is presented in figure 2.5. According to figure 2.5, the customer uses a complaint form to supply the customer's complaints, as shown in the lay complaint component of the customer complaint module. The customer can also view the response to the complaints.

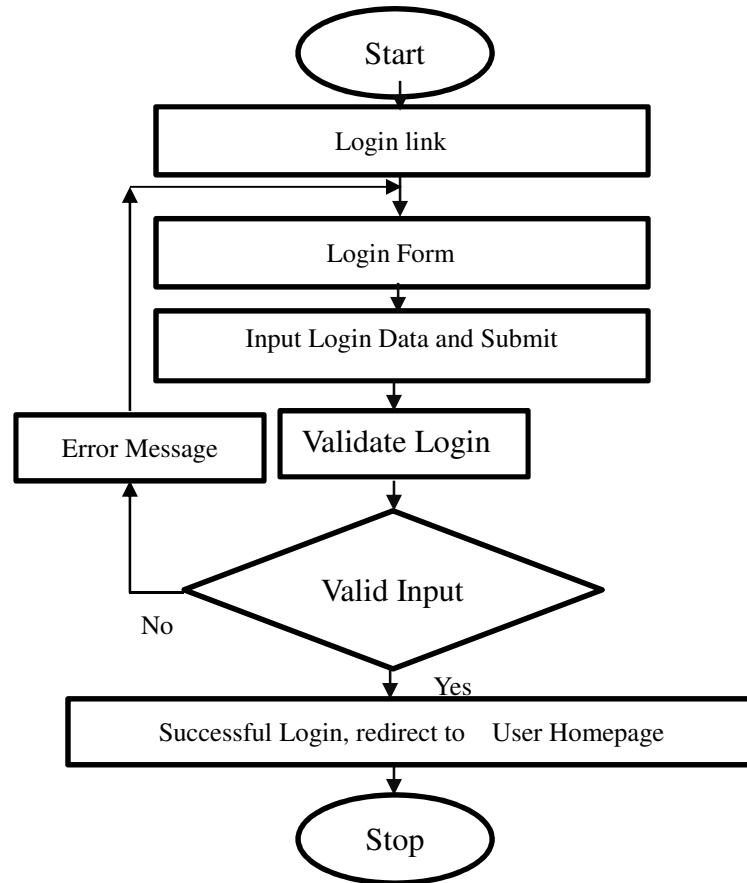


**Figure 2.2:** Functional Decomposition of the System



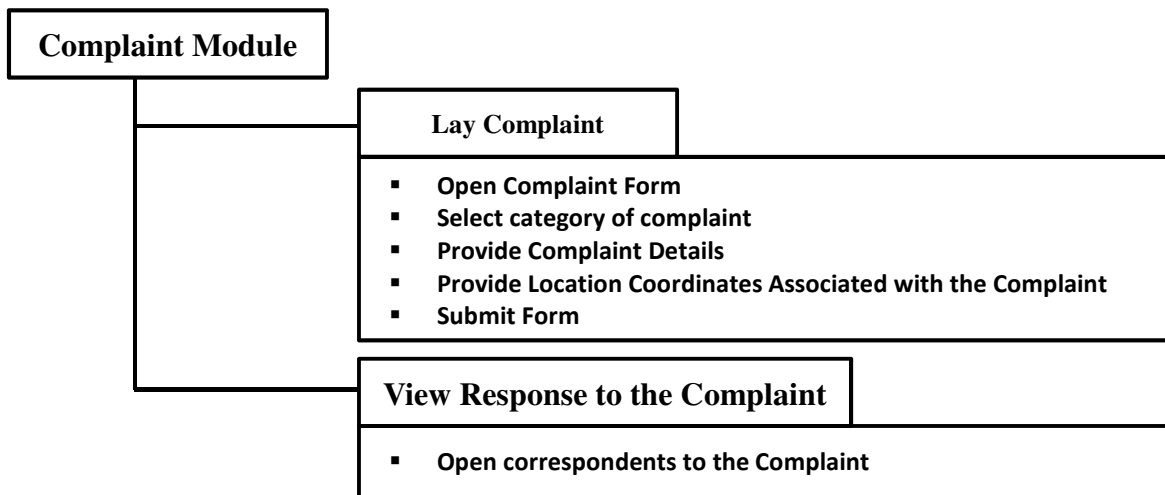
**Figure 2.3:** The Registration

Similarly, the administrative users at PHCN will also have access to the system by logging in with username and password. However, the administrative users will be redirected to the administrative user's homepage with administrative user privileges. With the administrative privileges, an administrative user can access similar modules like the customer but with higher privilege levels.

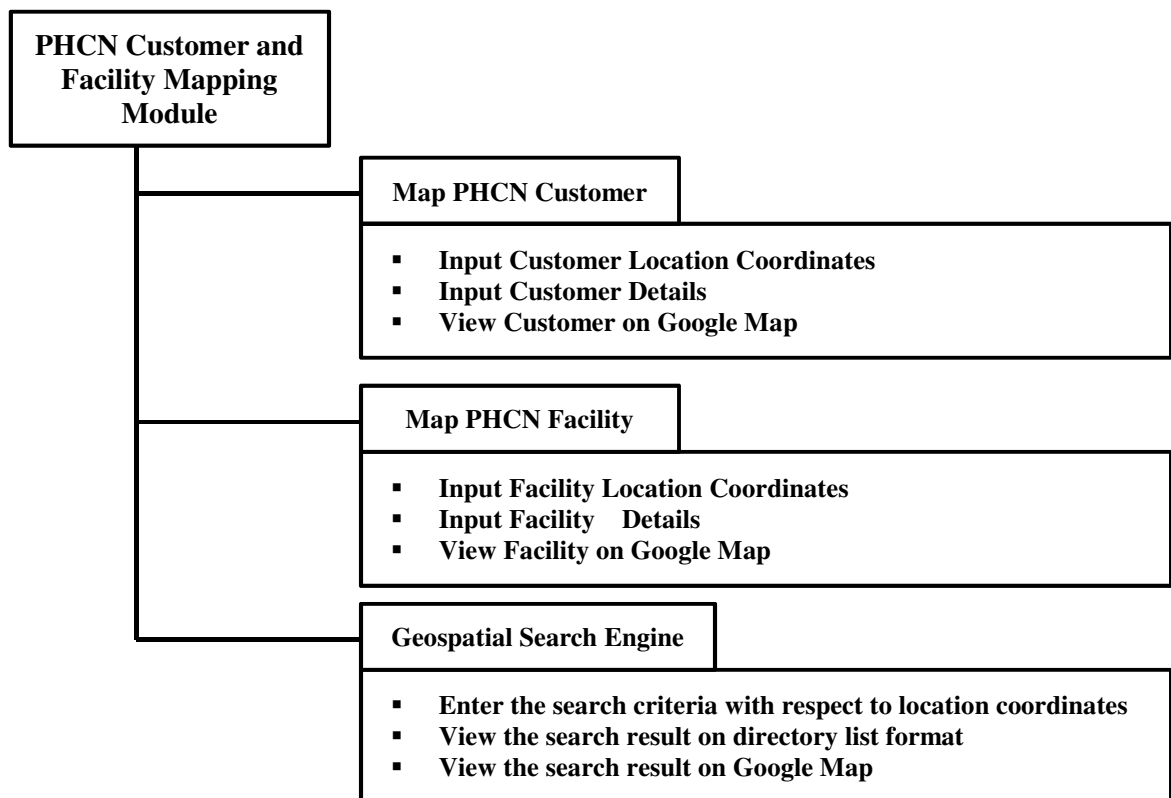


**Figure 2.4:** Login Process

The PHCN facility and Customer mapping module, figure 2.6, enable the PHCN staff to upload the geographic coordinates of PHCN facilities along with the facility’s description and other relevant information about the facility. The mapping module makes it possible for users of the system to visualize the PHCN facility on Google map. However, different users can access different facilities based on their user privileges. In all, the facility mapping module is useful for tracking faults and determining the possible coverage area of any fault. Furthermore, with the mapping module, the PHCN customers can also identify the facilities that they are connected to. Also, in reporting faults or making complaints, customers can use the facility mapping module to identify the customer’s location and the location of the facilities that are included in the complaint. The mapping module also extends beyond mapping facilities to mapping of PHCN customers. With the mapping module, the PHCN customer distribution can be visualized on Google map. Customers can be located and their issues addressed through the combination of facility mapping and customer mapping functionalities.



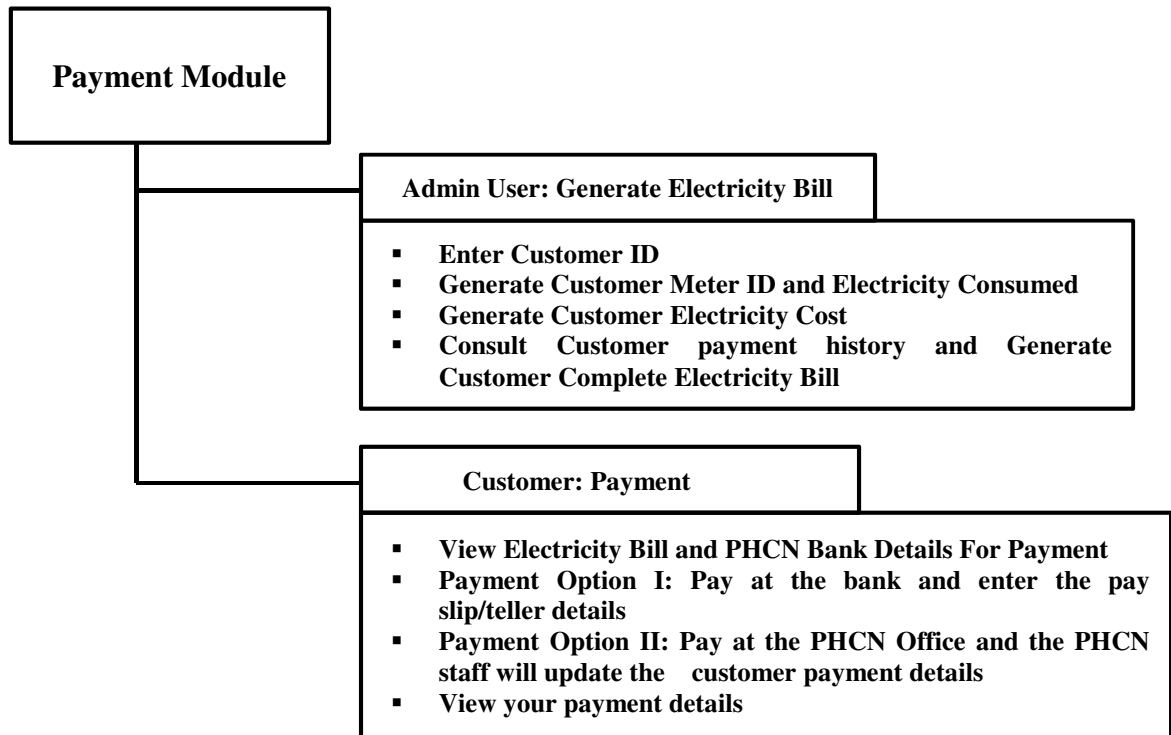
**Figure 2.5:** The Features of the Customer Complaint Module



**Figure 2.6:** Web mapping of PHCN Resources

The payment module, Figure 2.7, enables the customers to pay for their electricity bill. In the PHCN business unit studied, the prepaid meters are not yet installed. As such, the estimated billing system is in place. The present billing and payment approach is as follows; the PHCN staff generates the monthly bill at the end of the month and then distributes the bill to the PHCN's customers' houses and offices. The customers then proceed to pay at the PHCN office. On payment at the PHCN office, a receipt is issued to the customer. With the web application, the present billing and payment approach is as follows; the PHCN staff generates the monthly bill at the end of the month and then distributes the bill to the PHCN's customers' emails. Also, SMS alert system is used to

notify the customers of the electricity bill. There are two payment options in the new system. The first method is the existing method whereby, the customer proceeds to pay at the PHCN office. On payment at the PHCN office, a receipt is issued to the customer. The second option is for the customer to pay at the bank and sends the payment teller detail to PHCN through the PHCN website. On confirmation of the customer's payment teller details PHCN office will send electronic receipt to the customer's email.



**Figure 2.7 Payment Module**

The system implementation is achieved with the following tools and technologies: Operating System: Windows 7; Webserver: Apache; Scripting Language: PHP for server side scripting and Java script for client side scripting and Database: MySQL web server.

### **3. Results and Analysis**

The screenshot of The Homepage, Figure 3.1, provides a link for registration of new users and also for registered users to login with their username and password. The signup form or registration form for new members is shown in figure. 3.2. All the fields in the registration form are mandatory in the form and once a user successfully registers, the user can then login with the user's registration details, namely, username and password.

## Welcome to PHCN e-Customer



This Application Manages Customer Relation For power Holding Company Of Nigeria (PHCN)

Each Customer is expected to create an account and can visualise their location and other locations in the same District.

The Load estimation and Load forecasting can also be computed to determine the size of a transformer, cables and other power facility for each of these locations.

The application can also show boundary overlay (location of buildings and components), project facilities such as poles and transformers, etc.

### Links

Customer Login!

Username:

Password:

| [Forget Password?](#)

[New Customer? Register Here!](#)

### News

PHCN has introduced the Pre-paid Billing Meter System . Every customer is expected to visit the PHCN Head office and obtain one of these Meters to replace the old analogous Meters.

Deadline for Collection is by Monthend

**Figure 3.1:** The Homepage with Sign Up Link and Sign In Form.

Welcome to PHCN e-Customer



### Links

Customer Login!

Username:

Password:

| [Forgot Password?](#)

New Customer? [Register Here!](#)

## NEW CUSTOMER REGISTRATION

Firstname :

Lastname :

Email Address :

Gender :

Nationality :

State of Residence :

LGA of Residence :

Street Address :

Town :

Mobile No. :

Meter No. :

### Login Details

Username :

Password :

Confirm Password :

### News

PHCN has introduced the Pre-paid Billing Meter System . Every customer is expected to visit the PHCN Head office and obtain one of these Meters to replace the old analogous Meters.

Deadline for Collection is by Month end



**Figure 3.3:** The Home Page for Registered Members.

When the user logs in, the web application redirects the user to the user homepage, Figure 3.3. In the user homepage, the user can access the functionalities of the system. The user can submit complaint, as shown in Figure 3.4. The payment module is shown in Figure 3.5 and the invoice generated after the payment is shown in Figure 3.6. The screenshot in Figure 3.7 shows the mapping of user location.

Hi! Ikenna

Welcome to PHCN e-Customer

My Location

Complaints

Forum

Payment and Bill

### Your Details

Meter no: **QW001**

Street: **No 6 Okigwe Road  
Owerri**

City: **Owerri**

Mobile: **234803258585**

Email:  
**ameka.fee@yahoo.com**

LastLogin: **31-Jan-2015  
08:27:37**

## Complains

Complain History

Date	Title	Comment	Reply
2014-12-16	Low Voltage	We have been having low voltage in our street since Friday 12th of December 2014	awaiting admin response
2014-12-16	No Light	For over two weeks we have no light	awaiting admin response

Add New Complain

Area:

Subject:

Comment:

Latitude ::

Longitude ::

Picture ::  No file selected.

**Figure 3.4:** The Screenshot for the Complaint Module

Hi! Ikenna

Welcome to PHCN e-Customer

My Location

Complaints

Forum

Payment and Bill

Your Details

Meter no: **094001**

Street: **No 6 Okigwe Road  
Owerri**

City: **Owerri**

Mobile: **234813239585**

Email: **ikenna.fes@yahoo.com**

LastLogin: **27-Jan-2015**

**06:17:17**

Bill and payment

Bill History

Date	New Meter Reading	Previous Meter Reading	Service Charge	Amount	Status	Action
11-Dec-2014	400	0	500	4100	Paid	Paid
11-Dec-2014	600	400	500	2300	Unpaid	<a href="#">Pay</a>



Figure 3.5: The Screenshot for Bill and Payment

**Hi! Ikenna** Welcome to PHCN e-Customer

My Location

Complaints

Forum

Payment and Bill

**Your Details**

Meter no: **OW001**

Street: **No 6 Okigwe Road Owerri**

City: **Owerri**

Mobile: **234803258585**

Email: **emeka.fem@yahoo.com**

LastLogin: **21-Jan-2015 08:23:37**

**Bill Invoice**

Customer ID	UYU1
Fullnames	Ikenna Emeka
street	No 6 Okigwe Road Owerri
town	OW001
mobile	234803258585
Meter No	OW001
Longitude	7.03041
Latitude	5.48333
Category	
Status	Approved
Last Meter Reading	400
New Meter Reading	600
Service Charge	500
Billing rate	N9 per unit
Amount	N2,300.00

**Figure 3.6:** The Screenshot for Invoice for Bill

Hi! Ikenna

Welcome to PHCN e-Customer

My Location

Complaints

Forum

Payment and Bill

### My Location

Provide your coordinates for mapping of your location

Customer ID :: UYY1

Latitude :: 5.48333

Longitude :: 7.03041

Category ::

Picture ::

Browse... No file selected.

Status :: Approved

Update My Location

### Your Details

Meter no: **04W081**

Street: **No 6 Okigwe Road  
Owerri**

City: **Owerri**

Mobile: **234903288585**

Email: **imeka.fee@phcn.com**

LastLogin: **21-Jan-2015**

**08:27:37**

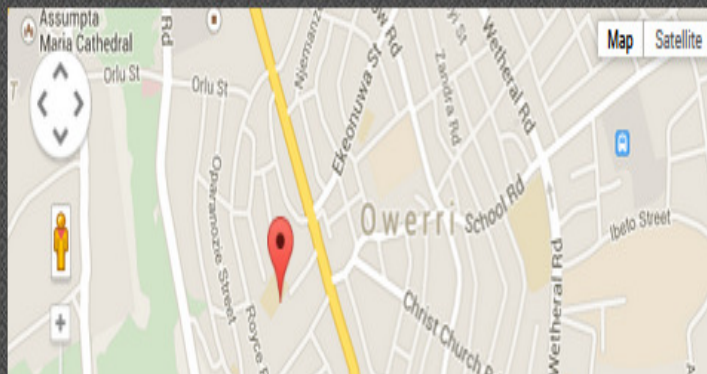


Figure 3.7: The Screenshot Showing the Location of Customer

## 4. Conclusions

The development of a web-based customer relation management services with customer and facility location mapping application for Power Holding Company of Nigeria (PHCN) is presented. Also presented is a third party mapping application based on Google map Application Program Interface (API) version 3 to enable the mapping of PHCN customers and facilities' locations. The methodology adopted for development of the software system is iterative methodology. The web application is implemented using PHP as the server side scripting language, Java for the client side scripting language, MYSQL for the database management system and it is hosted locally using Apache web server. Sample data are used to demonstrate the effectiveness of the customer care and customer mapping system.

## References

- [1] Boyinbode, O., Akinyede, O. (2015). E-Customer Care Service System for Benin Electricity Distribution Company. *International Journal of Computer Applications*, 116(7), 1-6.
- [2] Ardabili, F. S., Daryani, S. M., Molaie, M., Rasooli, E. H., Kheiravar, M. H. (2012). Importance of Mutual Relations on Customer Satisfaction in Industries with No/Low Direct Contact with Customers. *African Journal of Business Management*, 6(29), 8637-8643.
- [3] Amoako, G. K. (2012). Improving Customer Service in the Banking Industry-Case of Ghana Commercial Bank (GCB)-Ghana. *International Business Research*, 5(4), 134-148.
- [4] Addai-Minkah, M. (2011). *The Importance of Customer Service in the Banking Industry: The Case of Ecobank Ghana Limited* (Doctoral dissertation), KNUSTSpace, Institute of Distance Learning, Kwame Nkrumah University of Science and Technology.
- [5] Ngobese, N. (2011). *Client Perception of Service Delivery in the South African Police Service Community Service Centres in the Greater Durban Area* (Doctoral Dissertation), Department Of Marketing, Durban University of Technology.
- [6] Kishore Subban, M., Pillay, P., Bhowan, K., and Raga, K. (2007). Towards Effective Service Delivery via Customer Relationship Management. *Alternation*, 14(1), 34-58.
- [7] Peters, C., & Mazdarani, E. (2008). The Impact of Employee Empowerment on Service Quality and Customer Satisfaction in Service Organizations: A Case Study of Länsförsäkringar Bank AB: The Impact of Employee Empowerment. Västerås: Mälardalens högskola, 71.
- [8] Okiro, K., & Ndungu, J. (2013). The Impact of Mobile and Internet Banking on Performance of Financial Institutions in Kenya. *European Scientific Journal*, 9(13), 146-161.
- [9] Claessens, S. (2006). Access to Financial Services: A Review of the Issues and Public Policy Objectives. *The World Bank Research Observer*, 21(2), 207-240.
- [10] Sadeh, T., & Ellingsen, M. (2005). Electronic Resource Management Systems: the Need and the Realization. *New Library World*, 106(5/6), 208-218.

- [11] Turban, E., King, D., Lee J.K., Warkentin, M., Chung, H.M. (2002). *Electronic Commerce 2002: A Managerial Perspective*. NJ: Prentice-Hall International, USA.
- [12] Blakey, A. (2013). SunSpot: A Spatial Decision Support Web-Application for Exploring Urban Solar Energy Potential. *UWSpace*. <http://hdl.handle.net/10012/7499>.
- [13] Eldrandaly, K. (2007). Expert Systems, GIS, and Spatial Decision Making: Current Practices and New Trends. *Expert Systems: Research Trends*, 8, Editor: A.R. Tyler, 207-228.
- [14] Mennecke, B. E. (1997). Understanding the role of geographic information technologies in business: Applications and research directions. *Journal of Geographic Information and Decision Analysis*, 1(1), 44-68.
- [15] Sambo, A.S., Garba, B., Zarma, I.H., and Gaji, M.M. (2012). Electricity generation and the present challenges in the Nigerian power sector. *Journal of Energy and Power Engineering*, 6(2012), 1050-1059.
- [16] Adepoju, G.A., Ogunjuyigbe, S.O.A., and Alawode, K.O. (2007). Application of neural network to load forecasting in Nigerian electrical power system. *The Pacific Journal of Science and Technology*, 8(1), 68-72.

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