

Addressing The Challenge Of An Efficient Billboard Management In Accra Metropolitan Area

John Bleboo, Anthony Bawa, Alex Thompson

Abstract: *The urban planning of Accra has become very essential to develop the capital city of Ghana. The inability of the local government authority to efficiently managed billboards in the city by easily tracking the locations of installed billboards and effectively segregate the expired mounted billboards from the unexpired ones has become a major challenge. The need for an efficient system to properly manage billboards within Accra Metropolitan Assembly has become very essential. A web base system is developed to efficiently manage all billboards installed within the Accra Metropolitan Assembly in order to segregate the expired billboards from the unexpired ones and to improve revenue collection for the local authority. The Rapid Application Development model is adopted in designing the system using PHP, MySQL database, Bootstrap and JavaScript technologies. The developed system proves to be very efficient in managing billboards at various locations within Accra and the system also facilitates the easy collection of revenue for the metropolitan assembly.*

Keywords: *Accra Metropolitan Assembly, Billboard, System, Efficiently, Manage.*

I. INTRODUCTION

Advertising can be described as a marketing strategy to promote a product or service to prospective customers. The aim of advertising is to reach out to people who will most likely be willing to pay for a product or a service rendered by a company. Some companies will most likely advertise their services or products on big billboard within cities to attract customers. The proliferations of huge digital display within public space that serve the purpose of advisement billboards and information boards are being witness. [1] The use of billboards for the purposes of advertisement is significant in reaching out to customers. Billboards are mostly erected around shopping centre and sometimes along major streets in a city. This is usually done by locating a space at vantage points where billboards could be mounted for advertisement purposes so as to promote products and services that are available. In Accra the capital of Ghana, the mounting of huge billboards has become a big market avenue for outdoor advertisement industry where big companies in the Accra metropolitan area are competing for space.

Revised Manuscript Received on September 19, 2019.

John Bleboo, Department of Computer Science, Catholic Institute of Business and Technology, CIBT, Accra, Ghana

Anthony Bawa*, Department of Computer Science, Catholic Institute of Business and Technology, CIBT, Accra, Ghana

John Bleboo, Department of Computer Science, Catholic Institute of Business and Technology, CIBT, Accra, Ghana,

Currently in the Accra Metropolitan Assembly (AMA) the illegally mounting of billboards has become a major concern to the local government authority. The haphazard mounting of billboards in Accra has resulted in road obstructions which may sometimes lead to accidents in some cases. The installation of billboards sometimes create public nuisance where some companies that mount these billboards do not pay the required revenue to the AMA. In Ghana, the outdoor advertisement is one dominant medium for the advertising sector that has suffered some hindrances due to locations restrain and regulation of outdoor structures by government.[2] The need for a system to properly manage billboards has become very relevant for AMA. Outdoor advertising inventory includes the management of all signboards, the classification of billboards and the duration of lease for the space of the billboards. In this study, we seek to develop a billboard management system that is integrated with Geographic Information System (GIS) capabilities, thereby allowing the local government authority to effectively track and manage the mounting of out-door advertising billboards so as to minimize the illegal mounting of billboards. The system is designed by incorporating the features of GIS. Geographic Information System has some dynamic Internet mapping features within its product range such as Map guide, MapInfo and Intergraph. [3] The Billboard Management System to be design using GIS Internet mapping features will also allow for managing outdoor advertising structures. This will take into consideration of all activities that are associated with mounted billboards by individuals to advertise their products and services. Designing an efficient billboards system will keep proper records of billboards and clients' details, check the orderly process of mounting billboards and to give SMS alert to clients on the expired billboards. This will help to minimize the illegal mounting of billboards in Accra and ensure an efficient management of billboards.

A. Problem Formulation

The problem of an efficient management of billboards installed for advertising is of great concern to the Accra Metropolitan Assembly (AMA). The current manual system used by the AMA has some challenges which include, the inability of the local government authorities to track the location of every mounted billboard.

The local government authorities are unable to identify expired mounted billboards from the unexpired ones and the loss of revenue due to the ineffectively checking of payments for installed billboard

B. Objectives of the Study

The objective of this study is to develop a web base billboard management system for the local government authority. The study involves using software engineering techniques to design a system that can track every mounted billboard to its location with the use of Google map application program interface (API) and other GIS features. The design system will be able to differentiate expired billboards from unexpired ones. This will enable the AMA to take the appropriate actions in the siting and mounting of billboards within Accra. One other objective of the study is to develop an efficient database that can keep records of every mounted billboard and their financial transactions to minimise financial leakages.

II. RELATED WORK

The need for a system to effectively manage billboard for developing cities is very relevant. A well functioning system is required to effectively manage billboards which are usually large boards to display advertisement. Currently local government authority in Ghana use the manual approach that has prompted the need for a reliable billboard management system which will help the local government authority in managing the out-door advertisement using the current trending technologies. This will allow for a more reliable and efficient billboard management system for the local government authority.

Ignite OAX is a web base system from Watchfire for effectively managing billboards. [4] The system allows owners of billboards to sort out the available space whether digital or static and as well supports operational efficiency in managing billboards. The benefit of Ignite system is that it also allows managers of billboards to easily track the availability of space for advert and the geographical location of a particular billboard installed. However the shortcomings of the Ignite OAX cloud base system is that the system does not allow for the routing of paths to a particular location of a billboard. Also the system is not able to identify and isolate expired billboards from the unexpired ones that have been installed.

In a study done by Hui *et al*, (2015) [5] in designing a novel billboard management system using RFID technology. The developed system incorporated RFID tags which is embedded on the billboards to enable the identification of the billboards through an RFID reader. The system enables inspection staffs to properly identify billboards and the status of the billboards. Thus making the easy management of billboards within a particular location and the information displayed on the billboard. RFID tags are used to acquire information where an antenna can broadcast data via a wireless communication to a reader. [6] The problem with the RFID technology for billboard management system is that barcodes on RFID tags can easily get damage due to exposure to external environmental conditions. Also the use of RFIDs technology is quite expensive. Another study done by KE Xiaolong *et al*

[7] based on designing and implementing billboards system employs the use of web GIS and streetview map. The system developed uses measurable streetview map that employs the advantage of panoramic visualization and gives a reliable location of installed billboard. This system helps in the efficient administering of mounted billboards in specific location. However in this study, we seek to deploy an improved billboard management system with specific GIS features configured to address the challenges of the existing system for the Accra Metropolitan Assembly. The billboard management system to be developed is web base that employs web services to run the application via a web browser. Web base has some features that allow the application to be run on a mobile device. In using web services, the data from mobile device is updated from a remote database where the database can be projected. [8] The system is designed with innovative features that will help the local government authority to manage billboards more effectively in public space, generate more revenue and also to check the illegal mounting of billboards in the city.

III. METHODOLOGY

The appropriate methodology we adopted for designing the billboards management system is one that best fit the functional requirements of the system to be developed within the shortest possible time. Therefore the Rapid Application development (RAD) approach was selected for the design. The RAD model in software engineering is a framework used to structure, plan and control the process of developing a system. The Rapid Application Development model is best fit for the proposed system because the RAD model enables rapid delivery as it reduces the overall development time due to the reusability of the components and allows for a parallel system development. Also the RAD model will easily accommodate the changes in requirements of the system from the local authority and also the progress of the system development is easily tracked where the users requirements of the system is easily incorporated in the final development of the system.

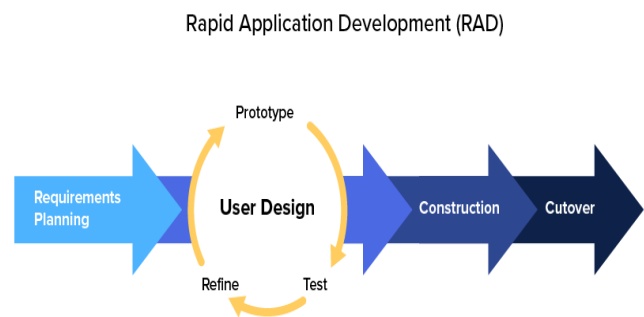


Figure 1 the Rapid application development structures (<https://kissflow.com/rad/rapid-application-development/>)

The rapid application development is divided into four phases where each phase a specific task is accomplish in the software development process within a short duration of time. The four

phases in RAD in designing the billboard management system are:

- **Requirement planning phase:** The requirement planning phase is the first step for a successful design of the proposed system where the system developers, customers and other team members communicate to determine the goals and functional requirements of the billboard management system during the requirement capturing process.
- **User design phase:** Once the problem is properly defined and the requirements are well defined for the system. The next phase in developing the billboard management system is the user designs by prototype iterations. The system developer presents a prototype, where the clients evaluate the system to communicate on what works appropriately.
- **Construction:** In this phase, the prototype of the billboard system from the design phase is then constructed into a real working model. There are several activities in this phase to convert the design prototype into the real system via RAD process. In this phase the various tests are done for the constructed system namely unit test, integration test and system testing.
- **Cutover phase:** This is the final phase in the RAD model where the designed billboard system is being deployed. The application is lunch and the users of the system are also trained in this phase to use the designed system

The tools used in the development of the web-based billboard managing system are; XAMPP Server (Apache services and MySQL Database), Visual studio code editor, Cascading style sheet (CSS), Hypertext Preprocessor (PHP), JavaScript and Bootstrap frame work.

A. Logical Design of System

The logical design is a conceptual abstract of the actual billboard management system to be design. We have a logical design represented in fig 2 from the conceptual models which is been transformed into the actual system.

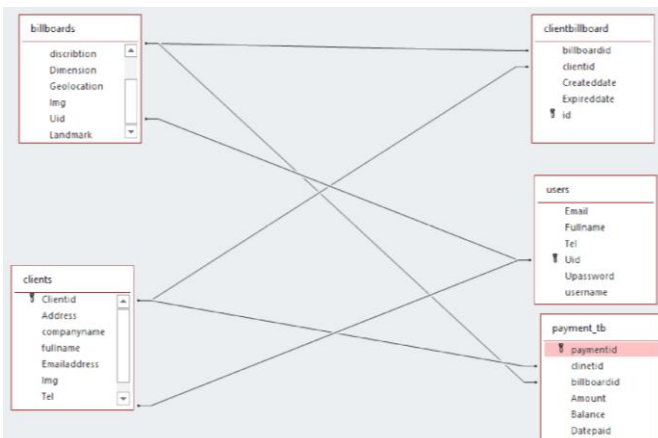


Figure 2 the logical design of the billboard management system

B. The Use Case Diagram

A Use case diagrams model the functionality of billboard management system using the main actors and the sort of activities that occur in the system.

The use case diagram for the billboard management system involves the administrator that manages billboards, tracking billboards location, adding new billboards space and registering clients who have requested for a billboard space.

A USE CASE DIAGRAM OF THE BILLBOARD MANAGEMENT SYSTEM.

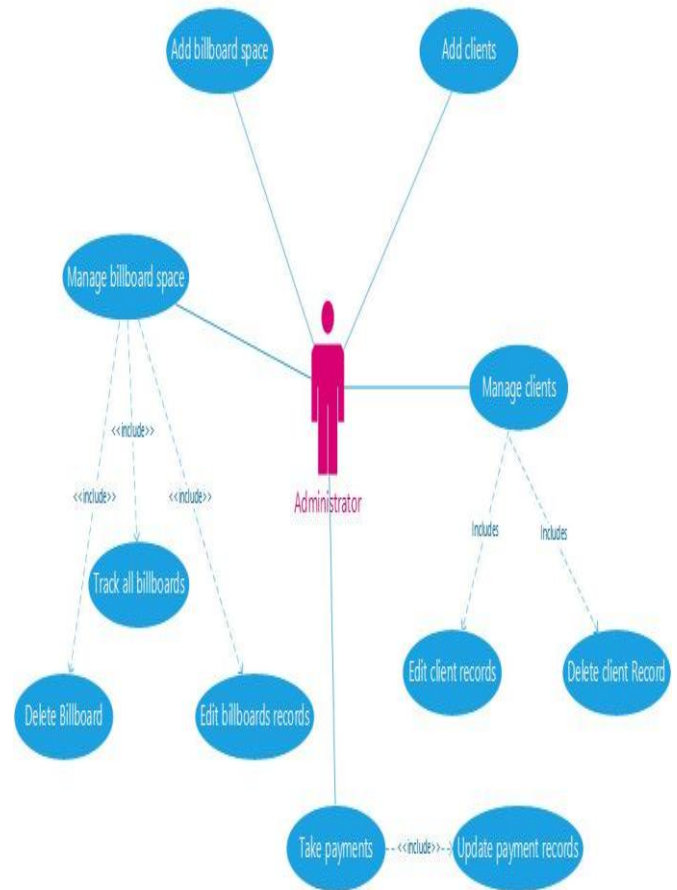


Figure 3 the use case diagram of the billboard management system

C. Sequence Diagram

The sequence diagram in the billboard management system depicts the objects interaction in system in a sequential order. It indicates the order in which the interaction occurs in the system. It involves the various processes and the sequence of messages exchanged between the objects in order to carry out the functionality of the billboard system.

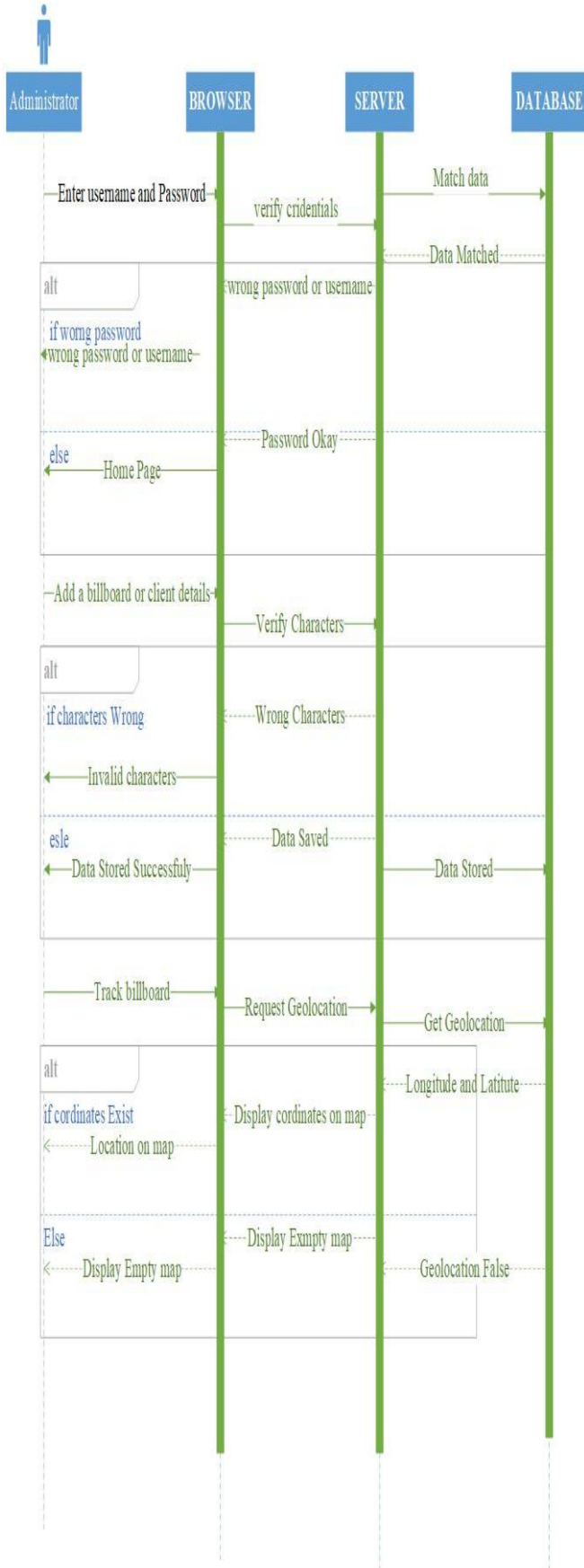


Figure 4 the Sequence diagram of the billboard management system

D. State Transition Diagram

A state transition diagram describing the various states for which the objects in the billboard management system can have and the sort of transitions the objects can go through in

the system. It also indicates how the various events under each object are carried out in the system.

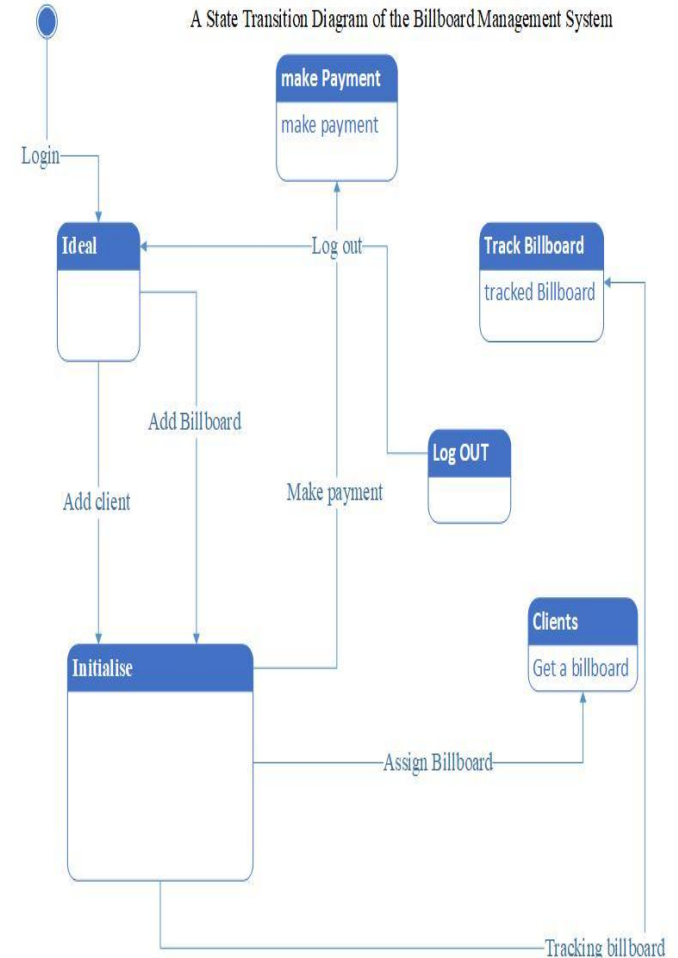


Figure 5 the state transition diagram of the billboard management system

E. The Database Design

The database design of the billboard management system involves the organization of database, implementation of database design model in MySQL and the maintenance of the enterprise database systems. Some tables in the database design of the billboard system are below;

Table1 for Billboard Management System

Dimension	Boardname	Description	Geolocation	Img	billboardid	Location	Uid
5X5	fanta	go near the district assembly	5.5585625,-0.20814819999999998		7	Accra new Town	2
4X4	champion dishes	in front of the bar	5.5596893,-0.2120639		8	Accra Adabraka	10
4X4	Tema station	in front of the bar	5.5591038999999999,-0.20807689999999998		18	Post Office Circle	5
6X5	fanta lemon	at the opposite of b	5.55954069999999994,-0.2081471		24	Accra Adabraka	4
4X4	pepsi	go near the station of the board where the system ...	5.55953659999999995,-0.20814159999999998		25	kantamatu	6
4X4	City campus	in the school gate	5.5569638,-0.2089992		26	accra	4
4X4	Eco Bank	in front of the bank	5.5596893,-0.2120639		27	circle	5
5X5	Ghana museum	go the right side of the museum	5.5596893,-0.2120639		28	CIBT-Accra	4
4X4	Accra porly clinic	got to the hospital	5.5613445,-0.2083173		29	TIGO-office ACCRA	10
4X4	Trust towers	come to the rust tower on top of the leal	5.5635442,-0.2081586		30	GBC-circle	6

Table 1 Clients Tablet from the Billboard Management System

Fullname	Tel	Email	Companyname	Address	Uid	clientid
kofi	0245438940	thompsonalex360@gmail.com	kabila	pox009	5	25
jeff	055146662839	alex360@gmail.com	jeffco ltd	POBOX 78	8	29
John dumelo	0205438940	dumelo@gmail.com	dumeloL TD	OXford street	0	30
sakordie	00383749373	scsack@gmail.com	sacksuccs	high street	0	31

IV. DESIGN IMPLEMENTATION

The home form provides the user of the system with the main components that enables the user to navigate through the entire billboard management system. Below is the home form of the system.

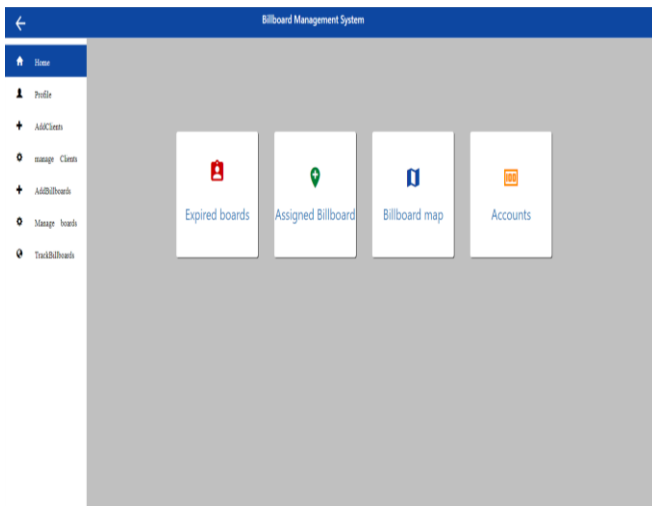


Figure 6 The home form of the system

i. Add New Billboard Form

The adding billboard form enables the user to add a new billboard into the system so that newly installed billboard can be assigned to a client. Below is the ‘add new billboard form.’

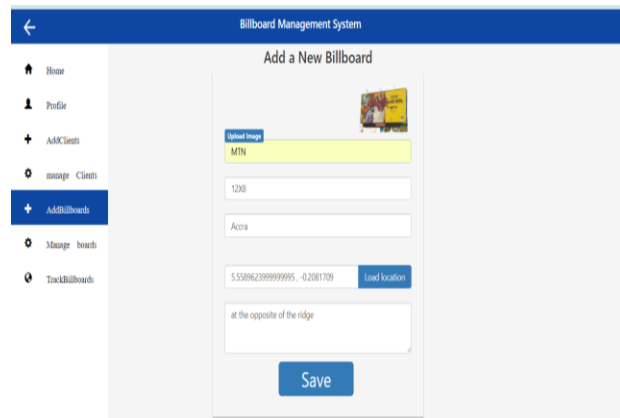


Figure 7 Add new billboard form.

ii. Manage billboards form

This is the form that provides the user with the needed actions to facilitate the managing of the available billboards in the system. In 8, indicates when a billboard has been assigned.

This form allows the user of the system to assign a billboard to the client who has purchase the space.

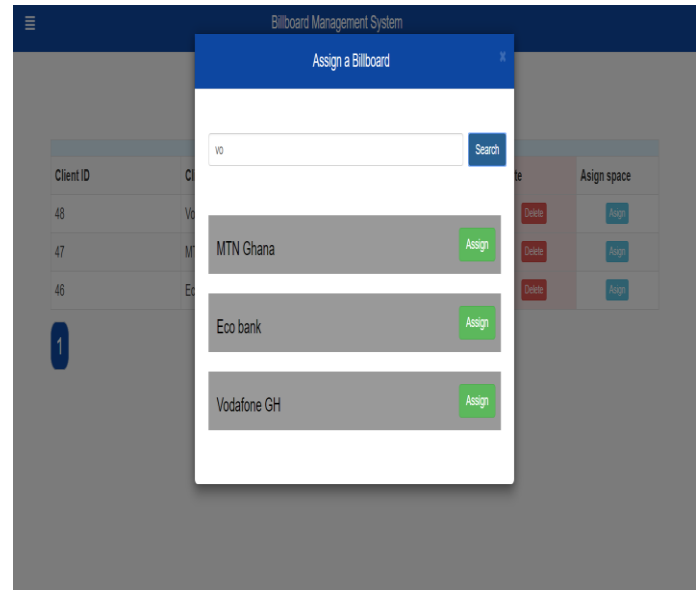


Figure 8 The form to Assign a billboard to a client

iii. Manage Client form

The manage client form gives users the opportunity to manage billboards assign to clients and also perform all actions that are related to a client. It is easy to know which client has been assigned a particular billboard within a location.

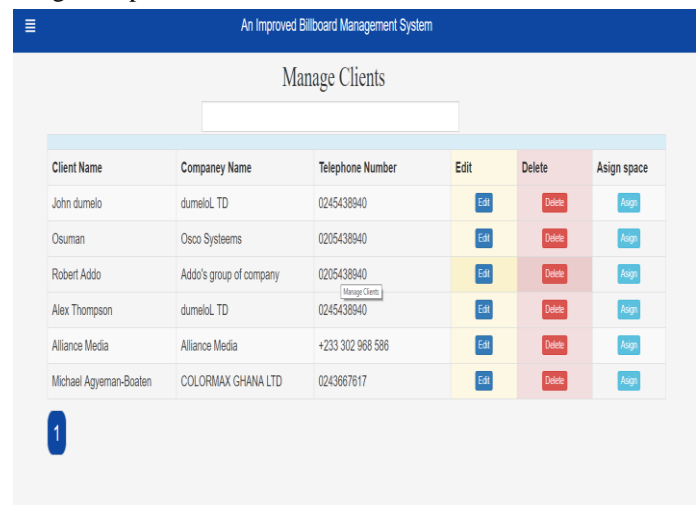


Figure 9 Manage clients with assigned billboard form

V. RESULTS AND DISCUSSION

In the designed billboard management system, the user can click a bottom to identified installed billboards within the Accra Metropolitan Assembly, know the clients who have been assigned the billboards and to determine when a billboard leased for a particular duration is expired or not. Also the system helps the user to determine which client has paid the required amount for a billboard space to facilitated the easy collections of revenue for the AMA. The designed system also helps in mitigating financial leakages and the easy administering of billboards for clients.

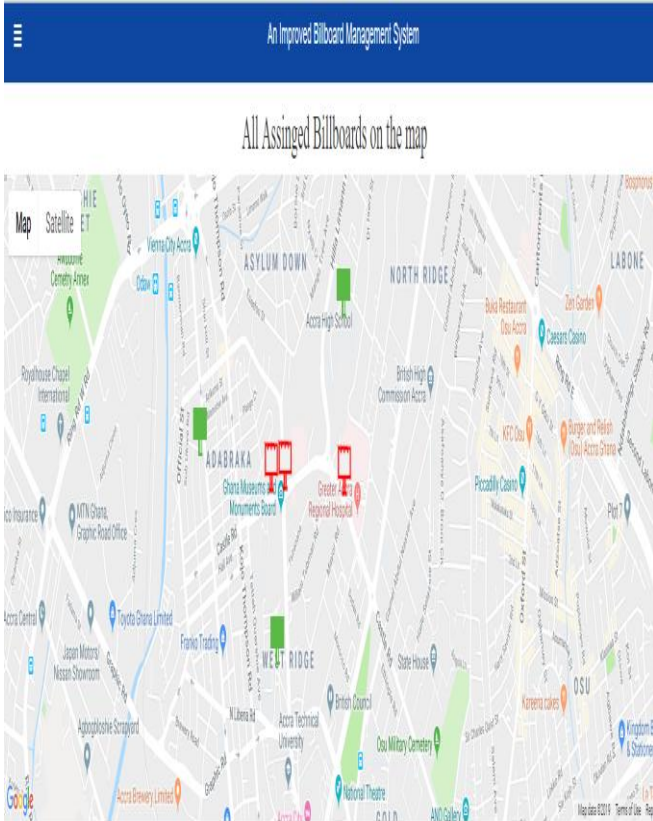


Figure 10 Differentiating expired and unexpired billboards

From the designed system the red marked billboard on the map indicated all expired billboards in the billboard system and the green marked billboard also denotes the billboards within a particular location that have not expired. The green marked billboard indicated the billboard is still within the lease duration period and the revenue accrued from a particular billboard. This allows the local authority to properly isolate expired billboards from the unexpired ones within a particular location.

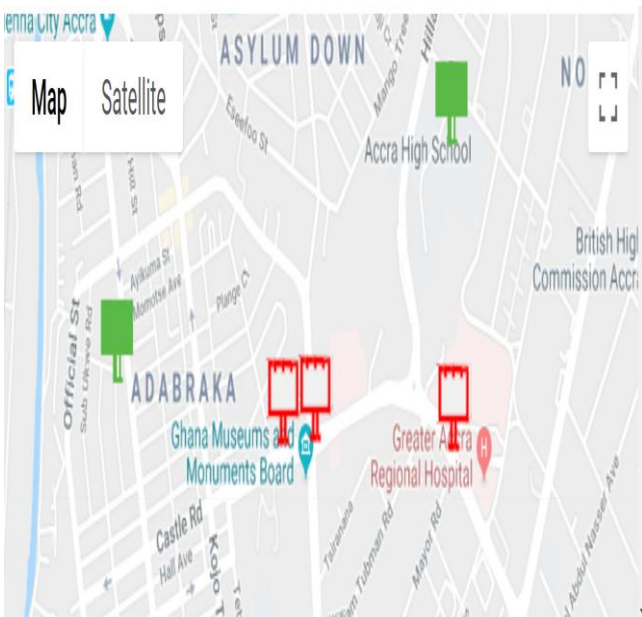


Figure 11 A zoom in location of installed billboard with the expired ones in red marked while the unexpired ones are in green marked

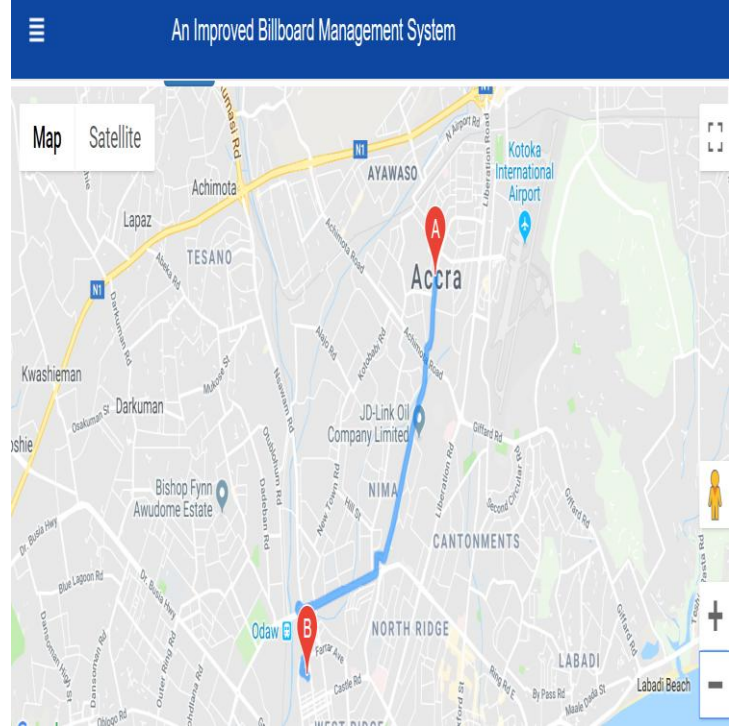
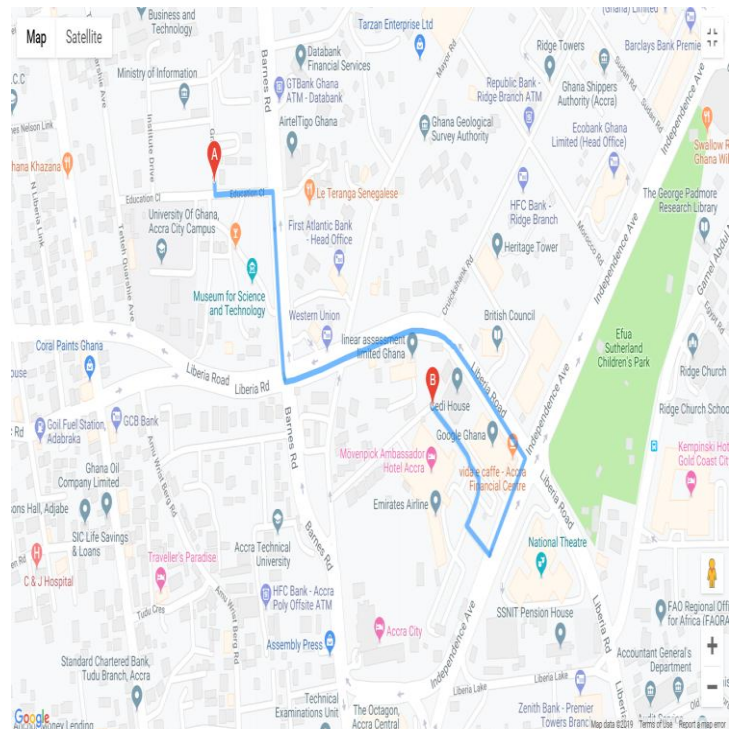


Figure 12 Routing the Paths to a mounted billboard

To make it easy to move from one billboard location to the other there is the need to know the routes from one location of the billboards. It is easy for the system to determine the routes to the various billboard locations. The system is able to route the paths from the current location of the user to that of the billboard. **Marker A** is the starting point and **Marker B** is the destination point where the billboard is located the map above shows the various paths to the location of a mounted billboard.



In order to properly evaluate the functionalities of the billboard management software meets the specified requirements we perform a testing of the system components. This is to identify any defects in the



system and to ensure that the system is free from any bugs so as to achieve a high quality system. The system is subjected to various forms of testing, which includes unit testing, system testing and integrated testing to remove all forms of errors in the operation of the system.

VI. CONCLUSION

In this study, we have been able to design a billboard management system to serve the needs of AMA. The main objective of the study is to design a system that can efficiently manage installed billboards within the Greater Accra metropolitan area. The problem of using manual ways of managing billboards has been of a great concern to the Accra Metropolitan Assembly. In the study we addressed the challenges faced by the local government authority in Accra by developing a system to ensuring the effective management of billboards. We deployed a web base system with Geographical Information System (GIS), making use of MySQL database, JavaScript and PHP. Also the designed system makes use of web service features that can be used with a mobile device to access information of a billboard from a remote server. The system allows staff of the local authority to easily track installed billboard within the geographical location and check the status of specific billboard. The system is able to separates expired billboards from the unexpired ones and the revenue generated by each mounted billboard. This innovation will help local authorities increase their revenue and ensure an efficient management of billboards in Accra. The system deployed is quite novel and will significantly help the Accra Metropolitan Assembly to efficiently managed all installed billboards within Accra. This system can be replicated in other districts and municipal assemblies across Ghana.

ACKNOWLEDGEMENT

We wish to acknowledge the Accra Metropolitan Assembly for assisting us with the primary data and documents to enable us conduct this study. We are grateful to the staffs of the Accra Metropolitan assembly for the required input in designing the system.

REFERENCES:

1. Harry Brignull, Yvonne Rogers “Enticing People to Interact with Public Displays in Public Spaces” Human-Computer Interactions – INTERACT '03, Published by IOS Press, (C) IFIP, 2003, pp. 17-24
2. Regina Appiah-Gyimah, Rosemond Boohene, Gloria K. Agypong, Kwame B “Customer Satisfaction in the Outdoor Advertising Industry: A Case of Alliance Media Ghana Limited” International Journal of Marketing Studies Vol.3, No.2, May 2011, www.ccsenet.org/ijms
3. Simon Doyle, Martin Dodge, Andy Smith “ THE POTENTIAL OF a. WEB- BASED MAPPING AND VIRTUAL REALITY TECHNOLOGIES FOR MODELLING URBAN ENVIRONMENTS ” Comput., Environ. and Urban Systems, Vol. 22, No. 2, pp. 137±155, 1998(C) 1998 Elsevier Science Ltd.
4. <https://www.ledsmagazine.com/specialty-ssl/article/16678942/watchfires-ignite-oax-business-management-software-supports-static-and-digital-billboard-operators>
5. Sep 26th, 2016, Ignite OAx Powers Comprehensive Management of Out of Home Advertising Businesses. Retrieved online: 7th September 2019.
6. Hui Jiang, Jianjun Yi, Shaoli Chen, Xiaomin Zhu and Zhuoran Wang
7. “A Novel RFID-Based Outdoor Billboard Management System ”

- International Conference on Advanced Manufacturing and Industrial Application(ICAMIA 2015)
8. G.Maanasa, K. Raghava, L. Anjali, P. Satyanarayana “An Interactive GPS AND RFID Based Receptacle Security System” International Journal of
9. Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8 Issue-4, April 2019
10. KE Xialong, LI Jiansong, LIU Jinbang, YU Yang “Design and Implementation of Billboards Management System Base on Measurable Streetview Map”
11. Journal of Geomatics 40(2): 71-73 April 2015 S. Muthuselvan, S. Rajaprakash, K. Karthik, R. Jaichandran, Suman Sharan
12. “Medicare Mobile Applications Implemented Using Android” International
13. Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8 Issue-4, April 2019

AUTHORS PROFILE



John Bleboo is a lecturer and a research at the Catholic Institute of Business And Technology. (CIBT) He holds a master degree in Information Communication Technology from Aalborg University, Aalborg, Denmark. He also holds another master degree in Structural Engineering from Vladimir Technical University, Vladimir, Russian. He has a certificate in ITIL IT Service Management from British Computer Society. His areas of research include IT Service Management, Software Engineering, Internet-Enable Application System, Database Design and Java Programming.



Anthony Bawa is a researcher in the department of computer science at the Catholic Institute of Business And Technology (CIBT). He obtained is postgraduate degree at Queen Mary University of London. His areas of research interest include Internet of Things, wireless sensor networks, distributed computing and software engineering.



Alex Thompson is a past student in the department of computer science at the Catholic Institute of Business And Technology. He is a currently a software engineer with a first degree in Bsc. Information Technology. He is very proficient in following programming Languages; Hypertext Preprocessor (PHP) JavaScript, Cascading style sheet (CSS), Hypertext Markup language (HTML) and java.