

## Analysis and Development of Customer Billing Telephony System

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### Abstract:

The telecommunications industry has gone through series of development efforts to provide quality services to their consumers. Generally, telecommunication industry provides two main services such as telephony and internet which involved customer registration, billing and payment. However, the challenge confronting telecommunications industry is to meet the customer satisfaction in the billing system such as accuracy, easy to understand and unambiguous billing issue. In order to develop Customer Billing Telephony System, a user experience study is conducted to gather the user requirements. Hence, the CBTS was developed that takes into consideration user's value experience that provides a support for managing and monitoring billing process. Then the CBTS was evaluated by the users using User Experience Questionnaire (UEQ) to prove the efficiency and correctness in billing process. The result shown that the users give the positive feedback of the CBTS.

**Key words:** Customer Telephony System, User Experience (UX) Study, User Experience Questionnaire (UEQ)

### Introduction:

The telecommunications industry through internet service providers and mobile communication is as a hub for supporting the growth, innovation, and disruption of others industry. Nowadays, mobile devices and related broadband connectivity continue to be more embedded in the society and they are the driving key trends such as video streaming, Internet of Things (IoT) and mobile payments(1). Since the telecommunications as the world's biggest machine which strung together, it allows us to speak, share thoughts and do business with nearly anyone, regardless of where in the world they might be. There are two main services such as telephony and internet provided by telecommunication industry that involved several processes for example customer registration, billing and payment.(2) Conversely, there are challenges met by telecommunications industry in order to meet the customer satisfaction such as accurately, easy to understand, performance and solving issues of billing system.

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User Experience (UX) is a process designing a product or technology that provide meaningful and relevant experiences to users. UX represents the holistic view with of the pragmatic aspect and hedonic aspect. Nowadays, UX is becoming an important issue and has been discussed by many researchers in developing web based system.

Therefore, we propose the customer billing telephony system (CBTS) using UX approach that considers a customer's value experience. In order to understand the concept, a thorough study on existing billing systems is required and the issues were considered as a fundamental understanding of customer billing telephony design using the persona. The CBTS is used to assist customer in focusing on the accurate billing, easy to understand and resolving billing issue. It is expected that by implementing this approach, it will improve the CBTS and gives the positive perceptions and experiences of a service which leads to high customer satisfaction. This paper consists of seven parts. Part II discusses the related work to CBTS. Part III elaborates on the methodology applied in developing the CBTS. Then, part IV explains the process of CBTS development. Part V explains CBTS and part VI discusses on evaluation of CBTS. Finally, part VII concludes the paper.

**Related Work:****Customer Billing Telephony System(CBTS)**

CBTS is about connecting via telephone the caller and receiver in a data network telephony system. Data network telephones support for an operation with a database and other user account information which include a location identifier such as address information, latitude and longitude configuration and direction. The CBTS is mathematical, statistical and logical processes which carried out on figures or data obtained from customers in order to produce information about billing status due for each customer which can be displayed as a summary report and bill (1). The bill is the most regular form of communication between the telecom companies and their customer (2).

There are numerous work being done on different aspects of customer telephony billing system such as in improving the customer satisfaction and loyalty. Simon and Krishna (3) reported from their study that customer satisfaction has the most significant positive effect on customer loyalty and reduce customer switching behaviour. Pensri and Rajabhat (4) proposed lightweight agent-based approach and secure mobile payment protocol to measure the performance of mobile payment applications and to supports multiple payments. Huang and Wang (5), proposed a new central billing system to consolidate all bills for one user so the user will not need to track and pay the bills individually. Im et. al. (6), presented the result from the analysis study where the mobile telecommunication need to focus on call centre, customer support service, trustworthy after service and improvement of corporate image, arrangement of various and the newest device (smartphone), and increase delivery speed in order to improve the customer satisfaction. Al Sharif Hago Almugadam Yusuf (7) investigated on the determinants accuracy of the Billing Systems in Sudanese Telecommunications companies for voice calls and SMS only. Azharuddin et. al. (8) developed a new web application using freeRadius framework to resolve the financial leakage in billing system. Oghojafor et. al. (2014) proposed a research model for the customer satisfaction and loyalty such as product, price, distribution, promotion and customer service. The data analysis has been performed using empirical method.

**User Experience (UX)**

User Experience (UX) approach include the user's preference, emotions, physical and psychological responses, perceptions, behavior and undertakings occur before, during and after using the system must be considered in designing the user

interfaces Rajeshkumar et.al (10). Factors such as user's state and past experience, system properties, and the usage context (situation) can influence a user's experience. The interdisciplinary areas involved in the UX Design are Interaction Design, Human-Computer Interaction, Industrial Design, Architecture, Information Architecture, Content Creation and Visual Design (the look and feel of the design). It also covers some areas of Mechanical and Electrical Engineering via the Industrial Design domain. S. Faily (11) used UX approach for engaging stakeholders of security requirement in elicitation and specifications. The approach is concerning capturing the information of security, usability, the assumptions about users and also the lack of end-user access. This approach was evaluated for a portal that facilitated medical study where the study data consists of long running and longitudinal studies of people sharing.

UX consists of five components namely information architecture, interaction design, usability, prototyping and virtual design. Information architecture is used to connect users to content. Second, interaction design is very related to graphics, images, fonts, color, icons that were used as interaction between users. Interaction design uses prototyping in order to define behaviors and functions of different components. Usability arrangements with leveraging data in order to determine the validity of design decisions. Then, prototyping is for testing and iterative feedback are based from stakeholders and users. Next, visual design is about communicating a company's brand and can be a dominant aspects towards desirable product. Hence, a product needs to use appropriate color, visual hierarchy and typography.

**Research Method:**

The development of CBTS involved several phases such as analysis, design, implementation and testing. In analysis phase, a survey was conducted to identify their target users in order to explain practices and challenges of the billing telephony system. In the design phase, a formulation of ideas is created to visualize human machine interaction. In the implementation phase, writing the code and testing the CBTS were conducted. Then CBTS was evaluated by users to identify the satisfaction and to get feedback or suggestion of CBTS.

**Table 1. Proposed customer billing guideline of CBTS.**

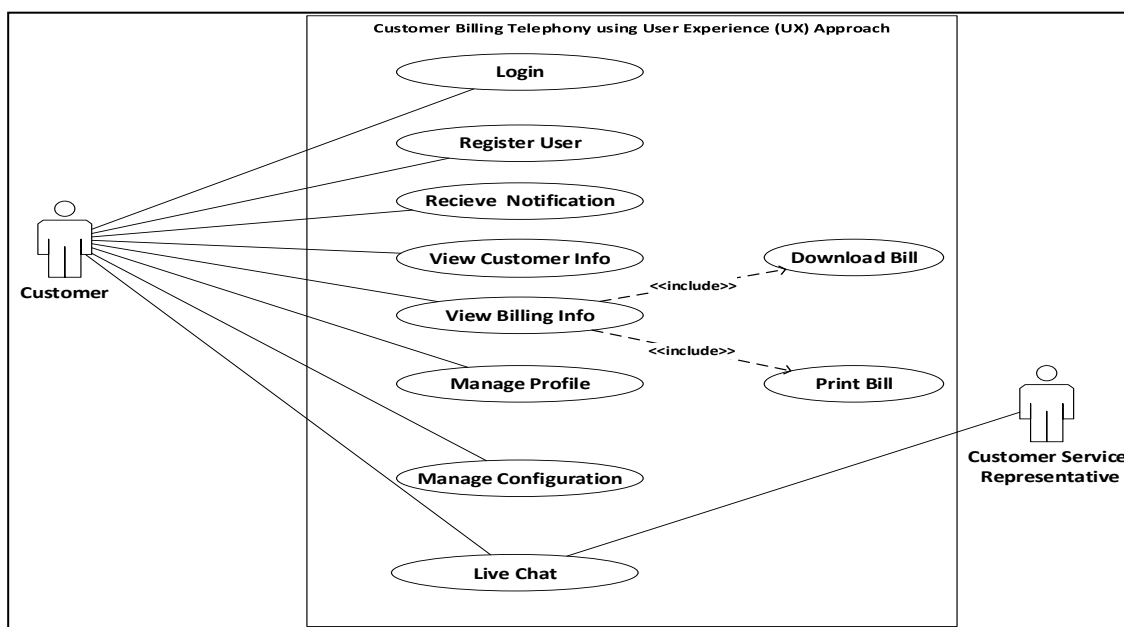
Guideline	Descriptions/Criteria
<b>Page Layout Guideline</b>	Divide the screen area into title, content, and navigation from top to bottom. The main content of the screen and the most important information should be shown at the top.
<b>Content Selection Guideline</b>	Provide content that is engaging, relevant, and appropriate to the audience. Only the most relevant and essential information should be shown.
<b>Visual and Interaction Design Guideline</b>	Select font and background color that provide sufficient contrast and would not prevent the visibility of text or links. Keep fonts large to optimize the reading process.
<b>Site Navigation Design Guideline</b>	Provide consistent navigation mechanisms. Use links to the main screen and do not repeat the navigation on every page. Use the “back” command. Balance the choice between scrolling and paging. Minimize the amount of scrolling.
<b>Guideline for Managing Hyperlinks</b>	Use text for links rather than images where possible. Clearly identify the target of each link. Provide large target size and padding.

**The Development of Customer Billing Telephony System:**

The CBTS was developed based on the proposed customer billing guidelines (as shown in Table 1). The CBTS helps in billing and payment process for post-paid mobile plan and fixed-line customers. The development of CBTS included four phases such as analysis, design, implementation and testing.

**Analysis**

At the requirements analysis, data of billing telephony system which concern about the existing process, roles and difficulties were gathered. The functionalities of the system were identified to show the interaction between the customer and customer service (Fig. 1). There are two actors involved in this model. First actor is Customer that is able to access the CBTS. They can view their detailed customer information, billing information, download bill, print bill, able to manage their account profile, configure their webpage. For any enquiry, they can directly communicate with Customer Service Representative via live chat. Second actor is Customer Service Representative which representative as invisible.



**Figure 1. Use Case for CBTS.**

**Design**

The tables for the CBTS were created during this stage. It consists of 13 tables that are illustrated in Table 2. The database design is crucial in developing a system or CBTS as it will be used as a basic tool to store and communicate with the application. Therefore it is important to properly

design the table structure and link between the tables to fully utilize each of the tables, so that the system can work effective and efficient. In CBTS, there are containing 13 of tables such as User\_T, Account\_T, Profile\_T, Cust\_Profile\_T and Cust\_Service\_Profile\_T.

**Table 2: Table for CBTS.**

No	Table Name	Description
1.	User_T	This table is containing the CBTS user info while register their account.
2.	Account_T	This table is containing the customer information.
3.	Profile_T	This table is containing the account profile information.
4.	Cust_Profile_T	This table is containing the customer account level information.
5.	Cust_Service_Profile_T	This table is containing the customer service level information.
6.	Account_Nam einfo_T	This table is containing the customer address information.
7.	Service_T	This table is containing the detail service information.
8.	Bill_T	This table is containing the summary bill information.
9.	Billinfo_T	This table is containing the detail bill information.
10.	Purchase_Product_T	This table is containing the detail product information.
11.	Purchase_Discount_T	This table is containing the detail discount information.
12.	Event_T	This table is containing the summary of event or activity happen for each customer account.
13.	Event_Bal_inm pacts_T	This table is containing the detail of event or activity happen for each customer account.

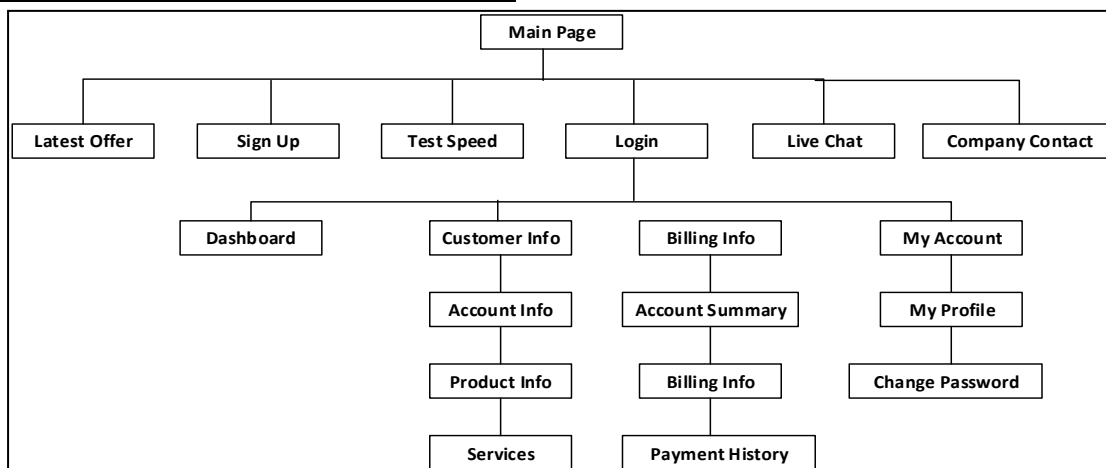
The architecture design of CBTS is using web application technology, whereby the application is accessible via web browser over a network such as internet or intranet. The CBTS is structured as a three-tiered application. First tier contains web browser which covers front end users to provide graphical user interface and interactive windows. Second tier includes Web Server (Apache) and Hypertext Preprocessor (PHP). Third tier provides database server that utilize MySQL in this CBTS project.

**Implementation and Testing**

Technologies that have been used for developing the CBTS are MySQL and PHP. A series of testing were conducted on the CBTS to make sure it functions effective and efficient. The test includes the entire CBTS including all types of process scenarios. In addition, the testing is conducted to determine the level of correctness, completeness, security and quality of CBTS. Then, the modification on the CBTS system must be done to comply the requirements specification defined.

**Customer Billing Telephony system (CBTS):**

The CBTS provides six main features which are latest offer, user registration or signup, test speed, login, live chat and company contact. For easy understanding, a user directory is presented as Fig. 2.



**Figure 2. User Directory of CBTS.**

From the CBTS main page, user can access both features from the menu selection that is placed on top and bottom of every page. In the bottom of main page, user can access three menu selections which are latest offers by company, the Speed Test menu to test the speed of internet and live chat

where customer is able to communicate with service provider.

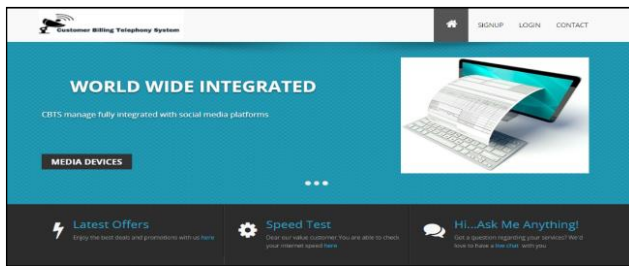


Figure 3. Main page for CBTS.

This main page containing three flash design information which can move every three seconds to give the brief information about the CBTS ( Fig. 3).

### Provide Customer Information

The users can view their detailed information regarding the customer information, account and services that have been subscribing billing, payment and adjustment history. In the CBTS, there is a micro white space which is the space between lines and characters that can make text easier to read. It can also guide user to the most important parts of a design with an extra amount of white space around. This element can act as a subtle highlight and also allows user to get the information they want quickly by making it easy for them to scan the design easily. The CBTS consists of clean layout with three colour scheme and lots of white space. A clean layout features a few stand-out elements, but largely relies on the colour scheme and white space to create the drama and interest. Each colour of button having their own meaning such as blue colour in send button is for normal, yellow colour in the Pay Now and View Alerts buttons are for warning. Lastly, the red colour in Log Me Out button is for danger. Besides that, the user is able to view, download and print the physical bill from this CBTS.

### Provide Communication with Users

Users prefer to communicate in real time such as using the live chat. Users suggest getting alert notification for each activity and process occurs such as updating the users account profile. The CBTS has the dynamic functionality which allows users to communicate directly with service provider via live chat as in Fig. 6. They are able to ask anything regarding the service offered by the service provider. This function can help user to reduce the waiting time to get the feedback and it is

free compared to the traditional method like call to call centre or email. The Company Contact page is also available which it gives the detail information about the company such as address, office phone number, Google map. User also can keep in touch with the company by fill up the email form or through media social like Facebook, Twitter and so on.

### Provide Accessibility for Disabilities User

In each of the header tab contains the setting button which develops to make easy for user to change the original CBTS design base on their preferences. The CBTS allows the user to customize settings for fonts, colours and font size in their webpage. This feature is suitable for the people with visual disabilities range from mild or moderate vision loss in one or both eyes (low vision) to substantial and uncorrectable vision loss in both eyes (blindness).. These variations in perception of colours and brightness can be independent of the visual acuity. Hence, by customizing these pages can make the content more readable and usable for their needs.

### Provide Navigation for User

Besides that, the navigation options appear consistently across all pages in CBTS. By providing consistent navigation throughout the CBTS design will allow users to feel confident that they know where they are and that they can find what they're looking for. Hence, this CBTS is having the Current Locator navigation which it is a way for users to know where on the page they currently are. When the user selects the tab menu in the header, the appearance shows the tab change to reflect that it has been selected. At the same time, the user can simply click on the home icon to go back to the home page. When the user clicks the menu, the list of submenu is displayed. The colour menu changes once the user hovers at it. The major sections of the site are available at every page. When the user hovers the mouse pointer to the tab menu and the button, the explanation message will appear. While, each of the detail information page from sub menu has their own search functionality, list of total number records that user want to display per pages and list of pages that they want to view as shown in Fig. 4.

PAYMENT ADJUSTMENT HISTORY				
10 records per page		Search: <input type="text"/>		
#	Date Created	Type	Amount (RM)	Description
1	12th December 2017	PAYMENT	-71.00	01   1   00     +   MAYBANK-INTERNET   0000100000   014   N
2	10th December 2017	ADJUSTMENT	-0.02	5 Sen Government Rounding
3	17th November 2017	PAYMENT	-71.00	01   1   00     +   MAYBANK-INTERNET   0000100000   014   N
4	17th November 2017	PAYMENT	-71.00	01   1   00     +   MAYBANK-INTERNET   0000100000   014   N
5	10th November 2017	ADJUSTMENT	-0.02	5 Sen Government Rounding
6	17th October 2017	PAYMENT	-71.00	01   1   00     +   MAYBANK-INTERNET   0000100000   014   N
7	10th October 2017	ADJUSTMENT	-0.02	5 Sen Government Rounding
8	10th September 2017	ADJUSTMENT	-0.02	5 Sen Government Rounding
9	6th September 2017	PAYMENT	-71.00	01   1   00     +   MAYBANK-INTERNET   0000100000   014   N
10	10th August 2017	ADJUSTMENT	-0.02	5 Sen Government Rounding

Showing 1 to 10 of 78 entries

Previous **1** 2 3 4 5 ... 8 Next

Figure 4. Current locator navigation in CBTS.

**Evaluation of CBTS:**

The evaluation is designed to evaluate the CBTS. The User Experience Questionnaire (UEQ) is used to evaluate the user satisfaction. This questionnaire was distributed to the respondents who are the customer. A total of 20 respondents in Klang Valley were chosen randomly and involved in this study. The UEQ allows a assessment of the user experience for any interactive product. The scales of the questionnaire are designed to cover a comprehensive impression of user experience. The questionnaire is supports the user response to immediately express feelings, impressions, and attitudes that arise when they are using the product. According to Martin et.al (2013),(12) the questionnaire contains six (6) scales with 26 items in total. Firstly, attractiveness is a general impression towards the product such as whether the users like or dislike the CBTS. This scale is a pure valence dimension. The items under these scales are annoying or enjoyable, good or bad, unlikable or pleasing, unpleasant or pleasant, attractive or unattractive and friendly or unfriendly. Second scale is the efficiency which the current CBTS design is very fast and efficient with organized user

interface. The items consist of fast or slow, inefficient or efficient, impractical or practical and organized or cluttered. Third is perspicuity which is to measure whether this CBTS is easy to understand and familiar. The items are not understandable or understandable, easy to learn or difficult to learn, complicated or easy and clear or confusing. The forth scale is dependability which it is to measure the user feel in control of the interaction such as secure and predicable. This scale consists of unpredictable or predictable, obstructive or supportive, secure or not secure and meets expectations or does not meet expectations. The next scale is stimulation which is to measure the interesting, exciting and feeling motivated to further use the CBTS. The items are valuable or inferior, boring or exciting, not interesting or interesting and motivating or demotivating. Lastly is the novelty. It is to measure whether the design of the CBTS is innovative and creative to grab user’s attention. This scale is containing of items such as creative or dull, inventive or conventional, usual or leading edge and conservative or innovative (Table 3).

Table 3. UEQ scales and items.

Scale	Items	Scale	Items
Attractiveness	annoying / enjoyable	Efficiency	fast/slow
	good / bad		inefficient/efficient
	unlikable / pleasing		impractical/practical
	unpleasant / pleasant		organized/cluttered
	attractive / unattractive		
	friendly / unfriendly		
Stimulation	valuable / inferior	Perspicuity	not understandable/understandable
	boring / exiting		easy to learn/difficult to learn
	not interesting / interesting		complicated/easy
	motivating / demotivating		clear/confusing
Novelty	valuable / inferior	Dependability	unpredictable/predictable
	boring / exiting		obstructive/supportive
	not interesting / interesting		Secure/not secure
	motivating / demotivating		meets expectations/does not meet expectations

Figure 5 is the result that automatically generated by UEQ data analysis tool. The items are scaled from -3 to +3 which -3 represents the most negative answer, 0 a neutral answer and +3 the most positive answer. When analysed, the following aspect should be considered. Scale values above +1 indicate a positive impression of the users concerning this scale, values below -1 a negative impression. More extreme values are rarely observed, so a value near +2 represents a very positive near optimal impression of participants. The CBTS is shown to have a very positive impression with the means of attractiveness is 1.63, perspicuity is 1.73, efficiency is 1.67, dependability is 1.61, stimulation is 1.4 and novelty is 1.12.

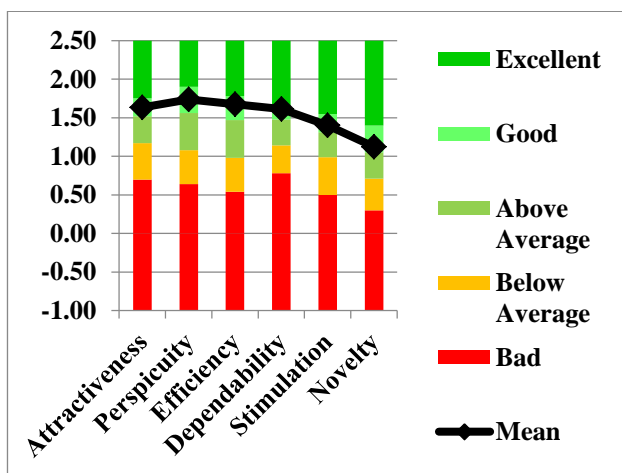


Figure 5. The Result of Quality Attributes.

Base on the result from the UEQ shown that all the scale components are in good level which give the best experience and user satisfaction when using CBTS.

**Conclusion:**

This research is about conducting a development of CBTS based on UX study. The development of CBTS included four phases such as analysis, design, implementation and testing. The analysis and development of CBTS was involved in studying user experience about the existing process, roles and difficulties of billing telephony system. Then, the functionalities of the system were identified. The user of CBTS is customer that is able to access the CBTS for viewing their detailed customer information, billing information, download bill, print bill, able to manage their account profile, configure their webpage and Customer Service Representative which representative as invisible. Both of this party will communicate with the customer via live chat. Then, the evaluation of CBTS has done using UEQ in order to get the feedback from users. The result shown by using the CBTS the users have a positive impression in term of attractiveness, stimulation, novelty, efficiency, perspicuity and dependability.

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**Conflicts of Interest: None.**

**References:**

1. Romanus, AC, Computerised Telephone Billing System. IOSR-JAP. 2014; (2278-4861), 6:13–20.

2. Sarkar, S. Billing Solution for Telecom Sector. Symbiosis Institute of Telecom Management, Pune; 2004.
3. Simon M , Krishna G. Exploring customer loyalty in the South African mobile telecommunications sector. Bus. Manag. J.. 2017;4(1), 1-16.
4. Pensri P , Rajabhat R. An Efficient of Secure Mobile Phone Application for Multiple Bill Payments. Proceeding of 30th International Conference on Advanced Information Networking and Applications Workshops . Crans-Montana, Switzerland; 2016;487-492.
5. Huang Y, Wang B. Central Billing System for Personal Bills. IJMT. 2014; 5(4), 323-326.
6. Im H, Seo DH, Bark DH, Park ST., An Exploratory Study on Service Quality Measurement of the Fourth Generation Mobile Telecommunication: The Case of the Korean Market. Indian J Sci Technol. 2015; 8(21), 1-12.
7. Al Sharif HAY., Accuracy Investigation of The of Billing Systems in Sudanese Telecommunication Companies; 2016. (master's thesis). Sudan University of Science and Technology College of Graduate studies, Retrieved from <http://repository.sustech.edu>
8. Azharuddin, Javed, A, Hanif, A, Azam, MA, Hussain, T. Development of Postpaid and Prepaid Billing System for ISPs. Proceedings of the IOARP International Conference on Communication and Networks 2015; 31-37.
9. Akpoyomare O.B.E, Patrick, L.K.A., Salome, I.O., and Victor, O.A., Determinants of Customer Satisfaction and Loyalty In The Nigerian Telecommunications Industry. BJMS, 2014; 2(5), 67-83.
10. Rajeshkumar S, Omar R, Mahmud M. Taxonomies of user experience (UX) evaluation methods. In 2013 International Conference on Research and Innovation in Information Systems (ICRIIS) 2013 Nov 27 (pp. 533-538). IEEE.
11. Faily S. Engaging Stakeholders in Security Design: An Assumption-Driven Approach. Proc Eighth Int Symp Hum Asp Inf Secur Assur (HAISA 2014) [Internet]. 2014;(Haisa):21-9.
12. Schrepp M, Hinderks A, Thomaschewski J. Applying the User Experience Questionnaire ( UEQ ). Part I, LNCS. 2014;(JANUARY):383-392.

## تحليل وتطوير نظام فواتير الاتصال الهاتفي للعملاء

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### الخلاصة:

مرت صناعة الاتصالات السلكية واللاسلكية بمجموعة من مراحل التطوير لتوفير خدمات عالية الجودة للمستهلكين. وتوفر صناعة الاتصالات السلكية واللاسلكية بشكل عام خدمتين رئيسيتين هما الاتصالات الهاتفية والإنترنت والتي تنطوي على عمليات تسجيل العملاء والفواتير والدفع. ومع ذلك، فإن التحدي الذي يواجه صناعة الاتصالات هو تلبية رضا العملاء في نظام الفواتير مثل الدقة وسهولة الفهم ومسألة الفواتير التي لا لبس فيها.

من أجل تطوير نظام فواتير الاتصال الهاتفي للعملاء، أجريت دراسة لتجربة المستخدم لجمع متطلباته. وبالتالي، تم تطوير (نظام فواتير الاتصال الهاتفي للعملاء) CBTS مع مراعاة تجربة المستخدم التي توفر الدعم لإدارة ومراقبة عملية الفوترة. تم تقييم CBTS بواسطة المستخدمين الذين أجروا استبيان تجربة المستخدم (UEQ) لإثبات الكفاءة والصحة في عملية إعداد الفواتير. أظهرت النتائج أن المستخدمين يقدمون ردود فعل إيجابية من CBTS.

**الكلمات المفتاحية:** نظام الاتصال الهاتفي للعملاء، دراسة التجربة للمستخدم، استبيان تجربة المستخدم.