

Adoption of Web Based Applications to Enhance Communication and Interaction Between Higher Learning Institutions and Alumni

A Study Conducted at University of Dar es Salaam

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Abstract— The improvement of web based technologies over recent years and implementation of web based communication and interaction applications has been key in communication and interaction simplicity. Currently, face to face and phone based communication means are mostly used at the University of Dar es Salaam. However, a rapid increase in the number of enrolled students, transport and phone accounts recharge costs are among the challenges complicating these two means.

Online communication is rarely used due to the inaccessibility of electronic mail contacts for most University members and alumni and the absence of an effective and reliable web based communication and interaction application where only authentic University members and alumni can effectively communicate and interact. Social networks are also used, though the anonymity problem makes it hard for University members and alumni to be sure if they are communicating with authentic University members and alumni.

This paper explores the challenges, approaches and recommends appropriate solutions that can be adopted to enhance communication and interaction in higher learning institutions. Both; qualitative and quantitative methods recommended in computing field were used with object oriented approach. An interaction model between University members and alumni was designed as a framework to guide the analysis and design of the desired effective communication and interactive model.

Based on the designed model, a web based communication and interaction application was developed under human centred approach, implemented, tested and evaluated. From 260 participants targeted, 243 evaluated the implemented application. The findings confirm that communication means evaluation, human factors and participants' involvement are key in effective and reliable web based applications adoption between higher learning institutions and their respective alumni.

Keywords- *Web based applications, Evaluation metrics, Human Computer Interaction, Human Centred design, Interactive Systems, Interaction Model, Users' satisfaction, Object oriented.*

I. INTRODUCTION

The impact of Information and Communication Technologies (ICTs) is already changing the organization and delivery of higher education. Educational methods, principles and socio economic forces that have driven the higher learning institutions to adopt and incorporate ICTs in teaching and learning include greater information access; improved communication; synchronous and asynchronous communication; increased cooperation and collaboration, cost-effectiveness and improvement of educational methods and principles [1].

The use of web technology in higher learning institutions settings has begun to change the face of education. In a web based environment, students can communicate and interact with their instructors, alumni and fellow students. The asynchronous nature of a web based interaction eliminate the constraints of time and location, but it also incorporates interactive communication capabilities related to face to face communication. These web based communication benefits help in saving time, travelling costs while avoiding transportation problems [2]. Several researchers who considered enhancing communication in higher learning institutions concentrated on enhancing communication between certain parties among various parties of members in higher learning institutions.

Communication enhancement among parties such as student to student, student to instructors, students to alumni were done under separate web based communication environments and lacked the much needed interactivity among the involved parties [2][3][4]. Due to this fact, the need for appropriate web based applications for communication and interaction enhancement between higher learning institutions and their respective alumni is inevitable. In Tanzania, higher learning institutions, specially the University of Dar es Salaam (UDSM) experience challenges in providing and maintaining effective means of communication and interaction among

students, instructors, administration and alumni. This study highlights issues to consider in overcoming those challenges.

Communication and interaction between higher learning institutions members and their respective alumni is important as it is through effective and reliable communication means higher learning institutions can easily benefit from alumni contributions both financial and academic contributions. Also, alumni can benefit by being provided with networking opportunities and career related events; as well as opportunities to have continued access to the intellectual life of the University, notably the latest research and opportunities to meet with old friends and renew their bonds with the University.

With effective and reliable communication and interaction means, students will be able to keep in touch with authentic UDSM members, get the needed experience and finally go for suitable career paths with respect to technological changes and changes in the world market of employment. Email contacts of UDSM members and UDSM alumni will be easily accessible but only to authentic UDSM members and UDSM alumni thereby expediting communication and interaction between UDSM members and UDSM alumni.

Current communication means at UDSM are limited as they can not easily be used to simplify important tasks at UDSM; curriculum development and review, convocation activities, practical training placements, academic and financial contributions strategies being among those tasks. Challenges such as high communication costs especially phone accounts re-charge costs with transport costs, family and work responsibilities and the rapid increase in the number of enrolled students affecting face to face communication.

Online communication and interaction at UDSM is achieved via electronic mails and social networking websites such as Facebook, Twitter and the like. However, with electronic mail there is a challenge of how UDSM members and alumni can be able to get electronic mail addresses of their fellow members unless they know each other either through friends or they had already met face to face.

With social networking, the anonymity challenge prevents UDSM members and alumni to be sure if they are communicating with authentic UDSM members or alumni. This is because with social networking communication it becomes very simple for someone to pretend being someone he/she is not for his/her own reasons. This is one of the key challenges of social networking communication as these websites allow users to register and communicate without requiring them to supply their authentic identities such as authentic identity numbers to verify that the person registering is truly an authentic one [5]. So, the absence of reliable web based communication and interaction applications at UDSM makes most UDSM members and alumni fail to easily communicate for UDSM and their own benefits.

Fifty years since its inception, UDSM still lacks web based application implemented for communication and interaction purposes. Web based systems emphasize effective user-interface design and information architecture; human computer

interaction (HCI) techniques, such as user centered design, evaluation metrics and usability engineering, play an imperative role in implementation of web based applications [6].

This paper explores the challenges and solutions that can be adopted to enhance communication between UDSM members and UDSM enabling them communicate in an online environment capable of accepting their registration numbers and staff identity card numbers during registration process for identification and authentication processes. This was done by employing both web based technologies and HCI techniques. As recommended from the HCI discipline; a human centered approach considers human requirements of the whole system (not just the user interface) and should focus on the entire interaction including usability and the broader user experience [7][8].

II. LITERATURE REVIEW

A. Web Based Technologies and Applications

Web based technologies are those technologies used in the creation of web based information systems (WBIS). These WBIS are information systems (IS) based on web technologies which share infrastructure and communication protocols of Internet or Intranets, for example the TCP/IP. The wide spread of communication technologies exploited by WBIS, i.e. Internet; make these information systems more pervasive than traditional ones [9].

Web based applications now offer competitive advantages to traditional software based systems allowing businesses to consolidate and streamline their systems and reduce costs. Focusing on deployment considerations; input validation, authentication and authorization, cryptography and data sensitivity, configuration, session, and exception management, and adequate auditing and logging to ensure accountability [10].

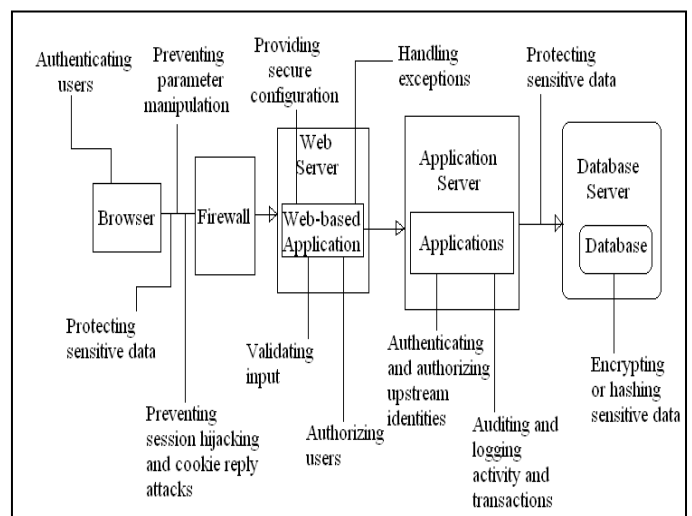


Figure 1. Top Issues to be Addressed with Secure Design Practices. [10].

B. Integration And Interoperability Of Web Based Applications

Web based applications are based on number of different web components written in different languages and frameworks. The components communicate to share information and data. Interoperability of software system is the ability to share information among different computing components, operating systems, applications and networks. Factors such the differences between web services standards and specifications, differences in error handling mechanism, and differences in protocols supported make the interoperability of web based applications difficult to be guaranteed [11][12].

System integration is the process of joining the subsystems physically or functionally to make them one functional system. Also, system integration provides the way to integrate new technologies into existing system and to join new and existing subsystems by gluing their interfaces together [11][12].

C. Evaluation of Web Based Applications

One major reason for evaluating web based information systems is to take actions based on the results of the evaluation to generate change and betterment. This is important due to several reasons among of which is the expensive failure and increasingly high level of expenditure on information systems [13].

Criteria based evaluation strategy as to how to evaluate strategy can be combined with web based applications in use as a what to evaluate strategy for effective evaluation based on users’ satisfaction with those web based applications implemented. However, user satisfaction in this study refers to the degree to which an individual user is satisfied with his or her over-all use of the application under consideration. Collective findings from prior web based information systems research suggest that user satisfaction is a strong and critical manifestation of systems’ success [14].

From HCI discipline point of view, HCI evaluation metrics should also be taken into account during evaluation of web based applications. Most commonly considered aspects include user task related aspects such as learnability, effectiveness, efficiency, and satisfaction that are regular usability dimensions. These metrics guide the tasks in the design phase and provide the standards for the summative evaluation in the implementation phase [7].

TABLE I. HCI EVALUATION METRICS [7]

Usability goals	User experience goals
Fewer errors	Aesthetically pleasing
Efficient	Enjoyable, entertaining, fun
Easy to learn	Motivating, engaging
Easy to remember and Safe to Use	Trustworthy and Satisfying

Collective findings from prior Information Systems’ research have suggested that user satisfaction is a strong and critical manifestation of a system’s success [14]. The evaluation process in this study was organized around functionality, feasibility and cost related evaluation criteria as described in figure 2. This evaluation technique was found to be very successful as it greatly decreased the effort of evaluation and made the evaluation process simpler for both an evaluator as well as system users.

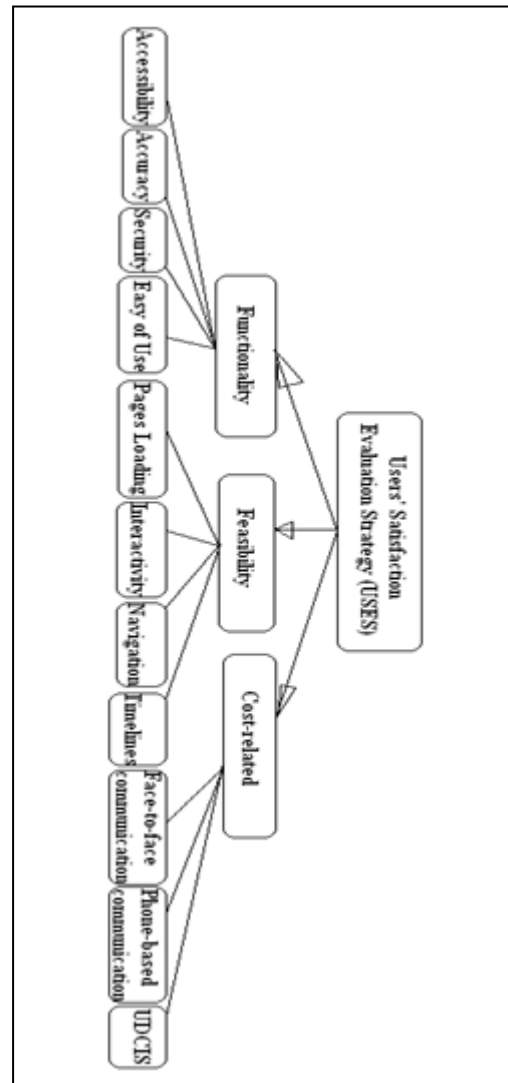


Figure 2. Users’ Satisfaction Evaluation Strategy [15]

D. Human Centred Design in Web Based Applications

The human-design process is key in effective web based applications analysis and design. The process was fundamental in designing effective interactive communication models as the base the implementation of effective and reliable web based communication and interaction applications. Figure 3. illustrates.

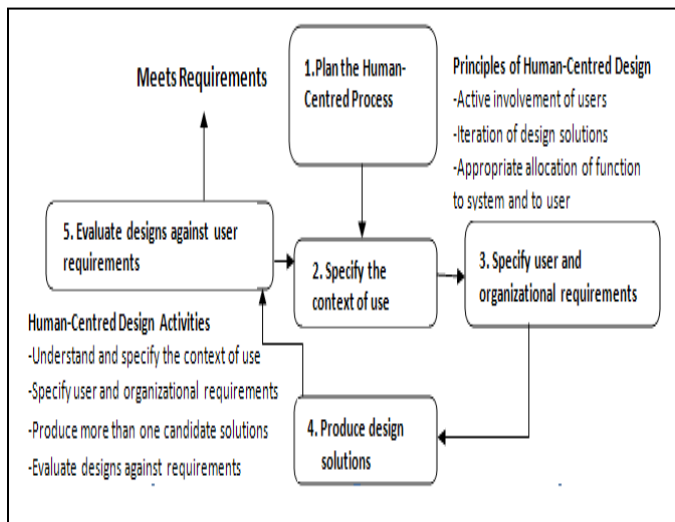


Figure 3. Human Centred Design Process [7]

Both ISO 13407 for human centred design process governed the design of the desired model and ISO 9241 standard for quality of use applicable for the design of interactive systems emphasizes the fulfilment of three main usability requirements for interactive systems: effectiveness, efficiency and satisfaction have to be applied for effective and reliable web based applications implementation [7].

E. HCI Life Cycles in Designing Web Based Applications Design in Web Based Applications

For the purpose of effective fulfilment of HCI principles and as recommended from the HCI discipline; a human centred approach considers human requirements of the whole system (not just the user interface) and should focus on the entire interaction including usability and the broader user experience. Incorporation of interactive systems and HCI life cycle models is key to effective and reliable web based applications implementations [16][17].

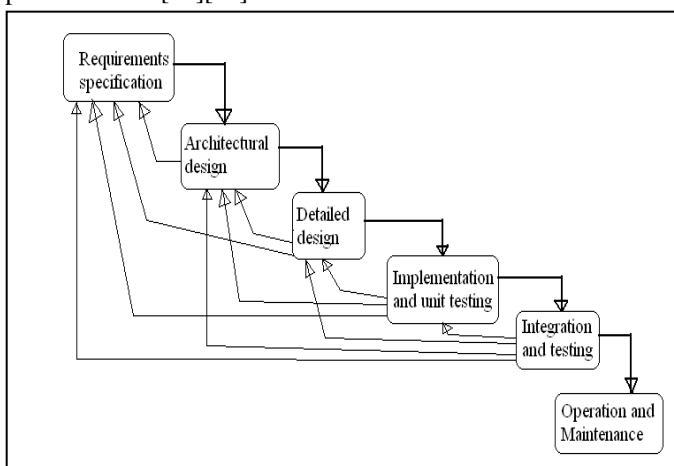


Figure 4. The Life Cycle for Interactive Systems [16]

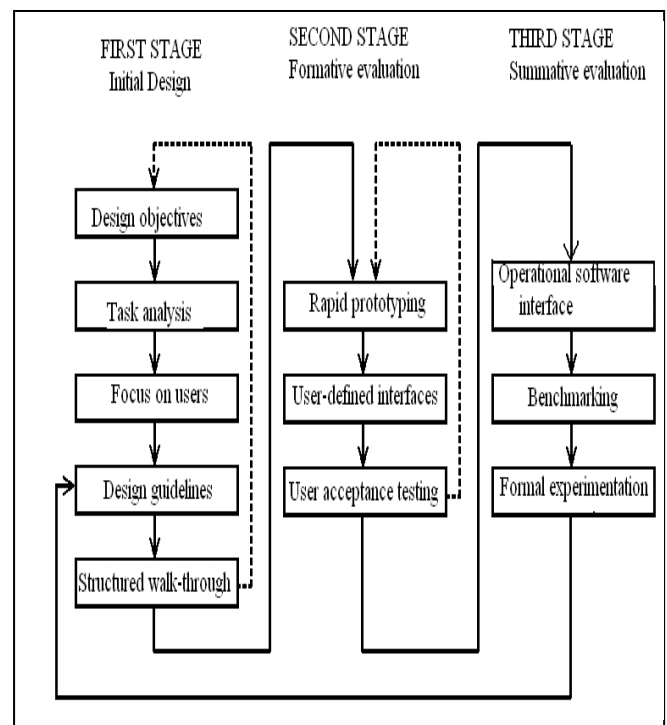


Figure 5. HCI Life Cycle Model [17]

F. Existing Communication And Interaction Means Status

Communication can be modelled as a set of connections along which messages flow from a sender to a receiver on some medium. A given interaction may require several such connections; even a simple web request requires two connections, one from the person requesting the page, and one to return the page to that person [18].

Various communication means are used in Tanzania higher learning institutions. Among these is face to face communication which is preferred though it becomes difficult as the number of members in those institutions increase. Transport costs and family responsibilities also affect this means of communication. Other challenges facing people communicating via this means include less time to think about the message delivered, synchronous based communication where the communicating parties must all be there and it is less likely to have a record of the discussion since most people don't record or transcribe their spoken communication [19].

Phone based communication is the other means used in higher learning institutions. Among the challenges facing this communication means is that any one who knows your phone number may try to call you for different reasons and possibly waste your time while at the same time leaving you with too many unwanted calls. The potential cost of using phone based communication, especially phone accounts recharge costs, is another challenge facing this means of communication. So phone based communication works out as an expensive and less effective means to be used [19].

The other means of communication is on-line communication which is the most effective, convenient and efficient especially in higher learning institutions. This means is less expensive and allows institution members to be accessible at any time as long as there is an Internet connection and a suitable web based communication and interactive environment [19]. Higher learning institutions need to ensure effective and reliable communication through the adoption of web based communication and interaction applications for communication and interaction enhancement.

G. Communication and Interactive Model Design

Based on object oriented approach, the conceptual model with three sub models (functional, object and dynamic sub models), should be designed using the Unified Modelling Language and being governed by Modelling Language for Interaction as Conversations (MoLIC) principles. The interface and navigation models should also be designed using appropriate programming languages for the interface model and appropriate indexes, contexts and links for the navigation model. Figure 6. illustrates.

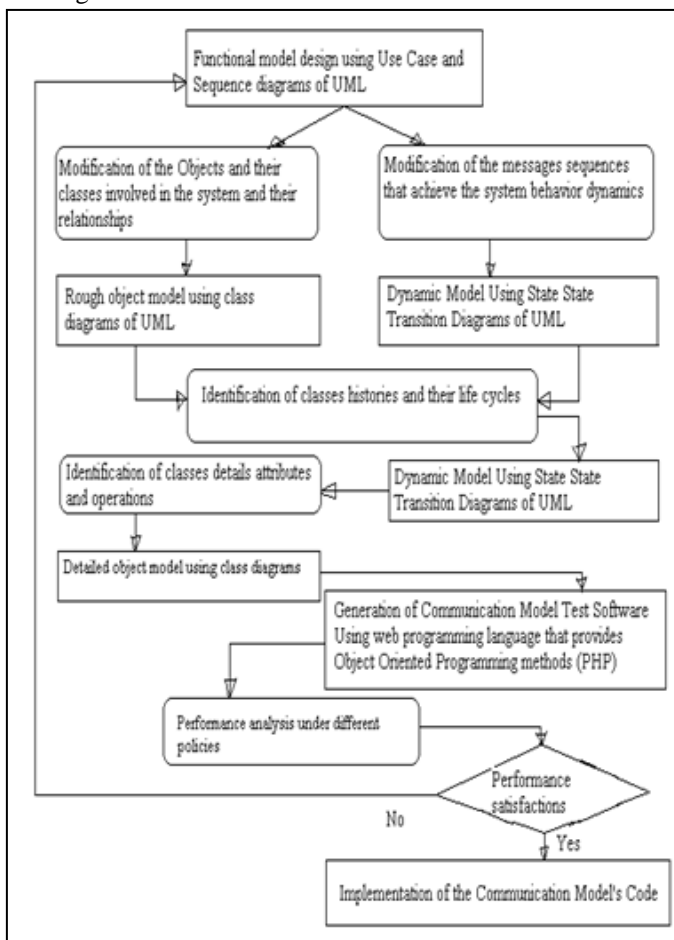


Figure 6. Methodology Employed for Implementation [20]

H. Proposed Interaction Model in Higher Learning Institutions

The model proposed for communication and interaction between higher learning institutions and alumni can effectively enable most of the conversations taking place via face to face communication also take place in a web based communication and interactive environment. The model in figure 7. illustrates the importance of implementing effective web based communication and interaction applications between the parties involved since the parties described depend much on each other in accomplishing various tasks.

The model goes further to describe important conversations taking place among the parties and the need for ensuring that these conversations, which generally occur in a face to face fashion take place in a web based environment. This model is appropriate since it does not exclude any important party among UDSM members and UDSM alumni and based on computer science and Internet security principles, the model goes further to prevent any external party to have access on it for anonymity problem control. can be modelled as a set of connections along which messages flow from a sender to a receiver on some medium.

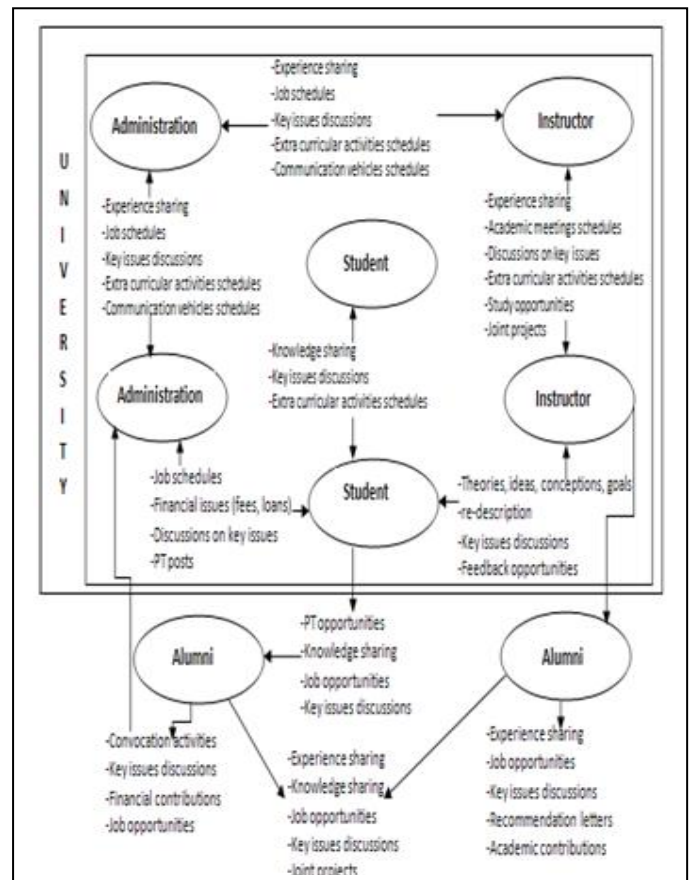


Figure 7. Interaction Model between UDSM Members and UDSM Alumni

I. Alumni Associations

An alumnus (plural alumni) is the person who was previously a member of a certain higher learning institution or someone who was previously a member or an employee of a certain institution. Different higher learning institutions globally have already recognized the benefits of maintaining effective and efficient communication and interaction between their institutions and alumni by establishing alumni associations and alumni systems [21].

In recent years, there have been numerous attempts by institutions of higher learning in Kenya and Tanzania to improve their Alumni Associations to make them more effective in performing their functions. Alumni are very important stakeholders in the institutions and when harnessed can play an important role in the execution of the mandate of the institutions.

Communication and interaction is among the preliminary goals of these associations. Alumni systems and websites play an important role in communication and interaction simplification between alumni and their respective institutions. Communication and interaction is key to several benefits alumni and institutions can have by keeping in touch [21].

Alumni are very important as they help the institution to overcome several challenges such as generation of additional financial resources for running their programmes from alumni contributions, enabling the institution to have access to a mass of human resources that can be utilized to support their various needs, to get greater student enrolments through promotional activities undertaken by their alumni, to improve their physical facilities for more effective training among others [21].

Due to that fact, good alumni relations can act as social controls through peer pressure and role modelling. They can contribute to a more effective human resource base to support societal development by improvement in facilities at local institution. This in turn, will attract highly qualified individuals who currently migrate to developed countries with such facilities [21].

III. METHODOLOGY

A. Study Design

The design of this study involved the analysis of the main means of communication and interaction currently used at UDSM, the design of the desired communication and interactive model for enhancing communication and interaction at UDSM, implementation of a web based application based on the designed model and finally the evaluation of users' satisfaction with the implemented application. Mixed research methods; qualitative and quantitative research methods as recommended in computing field were employed. These methods also helped to increase the results generalizability while providing strong evidence for reaching the conclusions and recommendations through convergence and collaboration of the study results.

Authors were also aided by an interaction model between UDSM members and UDSM alumni depicted in figure 7, a

human centred design process described in figure 3, systems development life cycle for interactive systems described in figure 4, HCI life cycle model indicated in figure 5 and the methodology employed for implementation of the desired web based application illustrated in figure 6.

The sample of the participants included UDSM members (students, academic and administrative staff) and UDSM alumni. The target of the study was to get 260 participants (100 students, 60 staff members and 100 alumni) for both data collection and evaluation. During evaluation, stratified sampling technique was applied.

Ten departments from three schools and three colleges of UDSM were sampled as categories or strata to ensure that greater precision is guaranteed. Ten students and ten alumni were selected from each stratum. Also six staff members were selected from each stratum.

In defining the sampling frame, the following departments from different colleges and schools at UDSM were used as strata; computer science, computer engineering departments (College of Information and Communication Technologies), economics, statistics departments (College of Arts and Social Sciences), mathematics, physics departments (Colleges of Natural Applied Science), education psychology and curriculum studies (School of Education), marketing, accounting departments (UDSM Business School), public law department (UDSM School of Law).

Though this technique required sufficient time but it sufficiently aided in attaining the precision needed and it was effective and suitable for this research study. The results obtained were both largely unbiased and accurate because it produced data that was more representative of the targeted population since it provided special attention to the smaller categories or strata within the population. In order to get most accurate results, authors ensured that no population element was excluded during stratification.

B. Evaluation Methods

During evaluation of the implemented web based application, evaluation forms were used to determine users' satisfaction with the implemented application. Both, hardcopy and online evaluation forms were used. UDSM members and UDSM alumni were involved in the evaluation process and completed the evaluation forms after accessing the application several times.

During this process, the users' satisfaction evaluation strategy described in figure 2 was used. Reliability analysis was done to study the properties of evaluation rubric dimensions and the evaluation criteria that make them up. In order to test the reliability, the Cronbach alpha factor was determined.

IV. RESULTS AND DISCUSSION

The results were grouped into two main groups. Firstly, results from analysis of existing means of communication and interaction used at UDSM. Secondly, results from evaluation of

users’ satisfaction with the implemented web based application. The analysis of existed means of communication and interaction with UDCIS was also provided as summarized in tables II and III.

A. Results From Analysis of Existing Means of Communication

Tables II and III summarize communication and interaction challenges at UDSM and solutions to be undertaken for effective communication and interaction enhancement between UDSM members and UDSM alumni.

TABLE II. COMMUNICATION AND INTERACTION STATUS AT UDSM

	Between alumni and UDSM administration	Between students and UDSM administration	Between students and alumni	Between academic staff and UDSM administration	Cost implications / Time factor/ Transport problems	Suggestions/ Possibilities
Online communication and interactive systems	Exists in some schools of UDSM	No	Exists in some schools of UDSM	No	Extremely low	Design and implement an effective web based application
Face to face communication	Exists for some	Exists for some	Exists for some	Exists for some	Very high	Switch to online means of communication
Phone based communication	Exists for some	Exists for some	Exists for some	Exists for some	Very high	Switch to online means of communication

TABLE III. COMMUNICATION AND INTERACTION STATUS AT UDSM

	Between alumni and academic staff	Between students and academic staff	Between alumni and UDSM members under one Communication Environment	Cost implications /Time factor/ Transport problems	Suggestions/ Possibilities	Between alumni and academic staff

	Between alumni and academic staff	Between students and academic staff	Between alumni and UDSM members under one Communication Environment	Cost implications /Time factor/ Transport problems	Suggestions/ Possibilities	Between alumni and academic staff
Online communication and interactive systems	No	No	No	Extremely Low	Design and implement an effective web application	Online communication and interactive systems
Face to face communication	Exists for some	Exists for some	No	Very high	Switch to online means of communication	Face to face communication
Phone based communication	Exists for some	Exists for some	No	Very high	Switch to online means of communication	Phone based communication

B. Evaluation Results

The evaluation process was organized around functionality, feasibility and cost related evaluation criteria as described in the Users’ Satisfaction Evaluation Strategy (USES). This evaluation technique was found to be very successful as it greatly decreased the effort of evaluation and made the evaluation process simpler for both an evaluator as well as system users. The feasibility and functionality evaluation criteria were governed by “Most Desirable”, “Adequate For the Purpose” and “Least Desirable” evaluation rubric dimensions while cost related evaluation criterion was governed by “High”, “Average” and “Low” evaluation rubric dimensions.

Participants who evaluated the implemented application were given access to implemented application then required to volunteer in complete the evaluation forms given to them and submitting them back to the authors for the analysis. From 260 participants targeted by this study, authors were able to get the evaluation results from 243 participants (95 students, 93 alumni and 55 staff). Tables 4.3, 4.4 and 4.5 summarize the evaluation results from students, staff and alumni of the University of Dar es Salaam who did evaluate the implemented web based application.

TABLE IV. UDCIS FUNCTIONALITY EVALUATION RESULTS

	Alumni	Students	Staff
Most Desirable	23	26	11
Adequate for the Purpose	54	42	31
Least Desirable	16	27	13
Total	93	95	55

Number of Cases (Evaluation Rubric Dimensions) = 3.0
Number of items evaluated = 3
Cronbach alpha = 0.9243

From 243 participants, 60 of them considered the functionality of the implemented application to be “Most Desirable” with 127 considering the functionality to be “Adequate For the Purpose” while only 56 considered the functionality to be “Least Desirable” as illustrated in table 4.

TABLE V. UDCIS FEASIBILITY EVALUATION RESULTS

	Alumni	Students	Staff
Most Desirable	24	23	9
Adequate for the Purpose	53	53	36
Least Desirable	16	19	10
Total	93	95	55

Number of Cases (Evaluation Rubric Dimensions) = 3.0
Number of items evaluated = 3
Cronbach alpha = 0.9903

From 243 participants, 56 of them considered the feasibility of the implemented application to be “Most Desirable” with 142 considering the feasibility to be “Adequate For the Purpose” while only 45 considered the feasibility to be “Least Desirable” as illustrated in table 4.5.

TABLE VI. COST RELATED EVALUATION RESULTS

	Alumni	Students	Staff
High	43	37	21
Average	38	40	26
Low	12	18	8
Total	93	95	55

Number of Cases (Evaluation Rubric Dimensions) = 3.0
Number of items evaluated = 3
Cronbach alpha = 0.9539

From 243 participants, 101 of them considered the capability of the implemented application to minimize communication costs to be “High” when compared with face to face and phone-based means of communication with 104 considering the capability of the implemented application to minimize communication costs to be “Average” while only 38 considered the capability of the implemented application to

minimize communication costs to be “Low”. Table 4.5 illustrates.

C. Summary of Participants Evaluation Results

From 243 participants who evaluated the implemented web based application, 25 percent considered the functionality to be “Most Desirable” with 52 percent considering the functionality to be “Adequate for the Purpose” while only 23 percent considered the functionality to be “Least Desirable”. For the case of feasibility evaluation criterion, 23 percent considered the feasibility to be “Most Desirable”, with 58 percent considering the feasibility to be “Adequate for the Purpose” while 19 percent considered the feasibility to be “Least Desirable”.

For the case of cost-related evaluation criterion, 41 percent considered the capability of the implemented application to minimize communication costs to be “Most Desirable” when compared with face-to-face and phone based means of communication with 43 percent considering the capability of the implemented application to minimize communication costs to be “Adequate for the Purpose” while only 16 percent considered the capability of the implemented application to minimize communication costs to be “Least Desirable”. Table 4.6 illustrates the results in tabular form while figure 5.1 illustrates the results in percentages.

TABLE VII. SUMMARY OF EVALUATION RESULTS

	Functionality	Feasibility	Communication costs minimization
Most Desirable	60	56	101
Adequate for the Purpose	127	142	104
Least Desirable	56	45	38
Total	243	243	243

Number of Cases (Evaluation Rubric Dimensions) = 3.0
Number of items evaluated = 3
Cronbach alpha = 0.8870

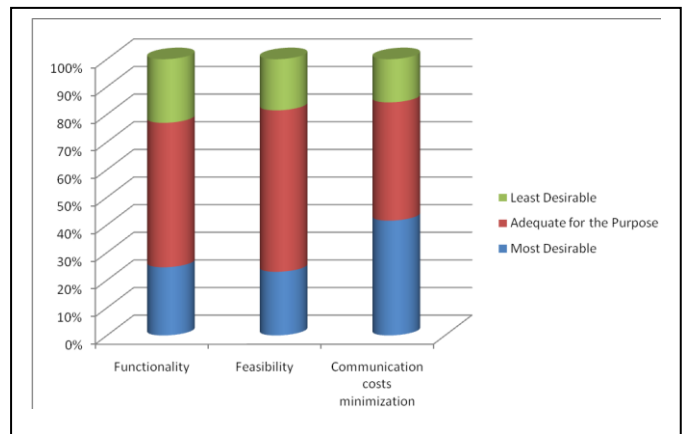


Figure 8. Evaluation Results Summary

D. Participants Satisfaction

In order to test the participants satisfaction with the implemented application, three evaluation criteria were used. Depending on each evaluation criterion, the reliability analysis test based on Cronbach alpha model was performed. For functionality, feasibility and cost related evaluation criteria, the reported values of Cronbach alpha of greater than 0.9 were obtained indicating good reliability and thus the application implemented measured correctly the evaluation criteria used. Since there is no definitive standard for reliability, Cronbach alphas of 0.7 or above are acceptable in most information systems research situations [21].

E. Comparing Existing Communication Means with UDCIS

As far as ISO 9241 standard for quality of use applicable for the design of interactive systems is concerned, the implemented web based application abbreviated as UDCIS (University of Dar es Salaam Communication and Interaction System) had to be evaluated by being compared with existing communication and interaction means checking whether the three main usability requirements for interactive systems: effectiveness, efficiency and satisfaction have been met. Tables 4.7 and 4.8 summarizes the results of the comparison made.

TABLE VIII. SUMMARY OF EVALUATION RESULTS

Communication and Interaction Means	Internet/Online Anonymity Control	Automatic Change of Users' Accessibility
UDCIS	Well controlled -Only UDSM members and UDSM alumni can register. -Registration numbers and staff identity card numbers are used. -Possible as the application has to be linked with the databases of UDSM members and UDSM alumni).	The application has the capability of changing accessibility of users' registering with students' accessibility to alumni accessibility once they graduate (by comparing the time of registration with the degree programme duration).
Existed Web based Systems	Controlled -Only certain parties involved -In most cases registration numbers are used while staff identity card numbers are rarely used. -Not for communication and interaction purposes.	Automatic accessibility change could hardly be provided.
Other websites used at UDSM including social networking websites(SNSs')	Not well controlled due to privacy issues. -Anyone can register provided has 13 years or above and resides in a country where SNSs' are not burned. -No authorized identity is used during registration.	Automatic accessibility change can hardly be provided.
Phone based means	Not Applicable (only	Not possible.

Communication and Interaction Means	Internet/Online Anonymity Control	Automatic Change of Users' Accessibility
	for online communication).	
Face to face means	Not Applicable.	Not possible.

TABLE IX. UDCIS AGAINST EXISTING COMMUNICATION AND INTERACTION MEANS ANALYSIS

Communication and Interaction Means	Communication Costs Estimates	Involved Parties	Information Tracking Services
UDCIS	Extremely Low communication costs (UDCIS implemented specifically for communication and interaction).	UDSM members and UDSM alumni from all schools and colleges of UDSM.	Easy to track important information (email contacts accessible only for UDSM members and alumni).
Existing Web based Systems	Costs could not easily be estimated (no system was implemented specifically for communication and interaction purposes).	Only certain parties involved (some parties left out, some schools and colleges left out).	Hard to track important information (some parties are left out, not designed for communication purposes)
Other websites used at UDSM including social networking websites	Low costs though difficult to be exactly sure if communicating partners authentic UDSM members or UDSM alumni.	All parties involved (but a challenge of being sure if communicating partners are authentic UDSM members or UDSM alumni)	Hard to track important information due to privacy issues in social networking websites.
Phone based means	High communication costs (phone accounts recharge costs, phone purchasing costs).	Some parties involved (need to know phone numbers of communicating partners).	Information tracking capabilities can hardly be provided.
Face to face means	High communication costs (transport costs, expansion of the University etc.)	Some parties involved (need to know whom to communicate with).	Information tracking capabilities can hardly be provided.

F. Communication and Interaction Enhancement Capability

UDSM for along time faced a challenge of how to bring its members and alumni together for the benefits of all the three parties; UDSM as an institution which requires both financial and academic contributions from its alumni, UDSM members (students, academic staff and administrative staff) and UDSM alumni. With that being the case, the need for an effective and reliable means of communication and interaction is inevitable and the implemented web based communication and interaction application is the right means of communication and interaction to be adopted.

The implemented application has provided users with information tracking capabilities which could rarely be obtained before. The application has been implemented in such a way as to control the anonymity problem existing in current social networking websites as far as computer science, design and internet security are concerned. This has been achieved by enabling UDSM members and alumni to get an access to the application by registering using staff identity card numbers for staff members and registration numbers for students and alumni. This capability has influenced most UDSM members and alumni to prefer using this application rather than social networking websites since it provides them with the assurance that they are communicating with authentic UDSM members and alumni.

The application has also helped UDSM instructors to easily follow the career development of alumni without being required to travel or make phone calls to various organizations where these alumni work. This has helped UDSM instructors to easily alter the modes of delivery of materials to students with respect to technological changes and changes in the world market of employment. Furthermore, email contacts of UDSM members and UDSM alumni are now easily accessible but only to authentic UDSM members and UDSM alumni, thereby being able to assist administrative staff in convocation activities and in expediting communication and interaction between UDSM members and UDSM alumni.

The study has provided UDSM alumni with networking opportunities and career related events; as well as opportunities to have continued access to the intellectual life of the University, notably the latest research and opportunities to meet with old friends and renew their bonds with the University.

The capability of the adopted web based application for enhancing communication was also evaluated by users based on its ability to minimize communication costs when compared with phone based, face to face communication means and other systems used for communication and interaction at UDSM such as social networking websites. Functionality and feasibility capabilities of the application were also important for evaluating the capability of the

application to enhance communication and interaction. This has been explicitly illustrated in Table VII and Figure 8 above.

CONCLUSIONS

This study concentrated on web based communication with main focus being on text based online conversations. Time delay and inefficiency factors also affect web based communication since even if you log on daily, 24 hours can seem like a long time if you're waiting for a reply and it takes longer than verbal conversation and so it's hard to reply to all the points in a message, easily leaving questions unanswered.

Being that the case, communication and interaction via the web based application implemented lack many non verbal cues that are used to interpreting in face to face conversations. Contextual information about where conversation partners are located and what they are doing is also reduced, this is due to the fact that knowledge exchange via online text based conversations is primarily explicit; tacit knowledge tends to be thin if present at all.

However, the implemented application can easily be used due to its convincing usability strategy which is one of the crucial parts of its design. The application is extremely user centric as it has been strongly designed focusing on users communication and interaction needs, putting users' needs and values at the centre of the application as recommended from usability point of view; an application is created for customers so it should be for customers.

Furthermore, authors emphasize on the importance of alumni engagement with their institutions through lifecycle interests, beginning as soon as a student enrolls and extending through life [22]. Higher learning institutions should never ignore the fact that communication and interaction hardships are key reasons for alumni not to engage in various activities taking place in their respective institutions, thus strong emphasize should be made in providing effective and reliable communication and interaction means.

This paper contributes to existing literature on communication and interaction in higher learning institutions specifically via web based environment. The paper has provided an effective interaction model which includes important parties between higher learning institutions and their respective alumni.

From a practical standpoint, this paper may help computing students and instructors in higher learning institutions, web based applications experts and web development companies as a reference guide to structure their architectural framework both in terms of the technological space that needs to be explored and also the business model that needs to be put in place to coincide with web based communication expectations of higher learning institutions members and their respective alumni.

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