

UNIVERSITY OF NAIROBI



SCHOOL OF COMPUTING AND INFORMATICS

**A MULTI-AGENT SYSTEM TO SUPPORT ICT BASED DISTANCE
LEARNING THROUGH MODELING OF LEARNER NEEDS: THE
CASE OF BACHELOR OF EDUCATION AT UNIVERSITY OF
NAIROBI**

BY

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**A proposal submitted in the fulfillment of the Requirements for Award of the
Degree of Master of Science in Computer Science of the University of Nairobi**

DECLARATION

I declare that this project, as presented in this report, is my original work and has not been presented for any other award in any other University.

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This project has been submitted as partial fulfillment of the requirements for the degree of Master of Science in Computer Science of the University of Nairobi with my approval as the University supervisor.

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DEDICATION

I dedicate this work to the Almighty God, who gave me the energy, the wisdom and the knowledge to accomplish this work. He says “Everything is possible for those who believe in Him”.

ACKNOWLEDGEMENT

First and foremost, I would like to thank the Almighty God for giving me this opportunity, insight and strength to accomplish this task. All the Glory be unto Him.

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ABSTRACT

In distant learning environments, most learners need feedback from lecturers and administration to support them so as to achieve their learning objectives. However, the feedback that the University of Nairobi distant learners receive through the student's portal is not timely. This leads to learners wasting time travelling to college to seek clarification on academic and administrative issues. The researcher used purposive sampling to select the learners to participate in the study. Thirty learners were used to get the system requirements for the proposed feedback system to support the learners. The pre-study done found out that the distant learners needed feedback mainly to support them while off campus. They needed updates on fees, center meetings, examination results, assignments, study schedules etc. The feedback should be communicated through email notifications and sms to alert them that new information has been posted on the website. The alerts provide a detailed summary of the information being relayed to the learners. The system was developed using the properties of agents to model interactive feedback system used in the distance learning environment. The system components are the learners, the lecturers and the administrator. These external agents interact via agents inside the system to support the learners. The system provides real time feedback to the learners hence will reduce on time wastage and extra cost on the side of learners.

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LIST OF ABBREVIATIONS

MAS: Multi-Agent system

LAAP: Learning Anytime Anyplace Partnership.

NLP: Natural Language Processing

NLTK: Natural Language Tool Kit

ICT: Information Communication Technology

D.E: Distant Education

ITS: Intelligence Tutoring System

FDD: Feature Driven Development

SMS: Short Message Sending

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

The *Information and Communication Technologies* (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video conferencing and distance learning (Raju,2008). When these technologies are used for educational purposes, such as to support and improve the learning of students and to develop learning environments, ICT can be considered as a subfield of Educational Technology. The use of information and communication technologies (ICT) in the delivery of education and management training has major implications for lecturers, learners and institutions. Whilst there is potential for major benefits for all concerned, it also continues to set a challenge for providers to develop new strategies for teaching and learning and raises fundamental questions about the learning process.

ICT has strongly impacted on the society and daily life. One of the areas of society that has been transformed is the way of learning and teaching (The commonwealth of Learning, 2006). There has been an exponential growth of internet-based learning. The transition to online learning technologies in education provides opportunities to use new learning methodologies and more effective methods of teaching (Georgieva et al, 2003).

Online learning is the use of network technology, namely the internet, to select, design, deliver, administer and extend learning (Hamdi, 2007). The importance of online learning is that there is separation of learners and teacher and so can take place anywhere, at any time at any place (Kabassi & Virvou, 2004). Online learning also overcomes the limitations of traditional learning such as large distance, time, budget or busy program and offers an opportunity for getting education no matter where you are. It also provides better quality and a variety of lecture materials (Georgieva et al, 2003).

In many findings there is rising need to redesign curricula models that are less prescribed and driven more by learner needs using Web technologies; all of this requires educators to expand their visions of pedagogy and learning (Selwyn, 2010).

Distance learning aims at target groups with special characteristics and imminent learning needs (adults, remote students). Thus it deals with course and instruction design, selection dissemination and evaluation of educational material (Govandasamy, 2002).

Institutions offering education by distance mode: Mills, (2003) puts “Those institutions which are successful in the future may find that it is the quality of learner support services which provides the competitive edge as more and more learning materials become available from a wide range of providers. Institutional managers will continue to regard learner support as an optional “add-on” at their peril.

An essential aspect of any distance education project is the support services that are available to the students (Muchiri, 2012). Learners cannot not easily achieve success in distance learning environment if they are not provided with learner support system. The success or failure of learner support will be judged on a number of performance indicators. The most obvious of these is probably the rate of success of the learners. However, while there has been substantial literature on methodologies relating to the production of learning materials and resources for distance learning, little has been done about the planning and management of learner support (Tait, 2000).

The concept of learning needs stems from adult learning theory. Through a process of reflection, the learner identifies deficiencies in knowledge or skills with the aim of meeting these needs through the creation of an action plan (Knowles et al., 2011). It is the initial step in continuing professional development. Indeed, learning is more likely to change an individual’s practice when it has stemmed from a learning needs assessment. Understanding learners is critical in providing appropriate support services for the survival of distance learners (Ji-Yeon, 2000).

Learners enrolled in distance learning challenge the traditional model of teaching and learning as well as service delivery. Administrators and staff are being asked to “explore strategies that respond to the individual needs of learners’ in a new learning environment (Van Dusen, 1997, Saelens, 2004).

Though learner support services have been recognized by learning institutions, there is still need to envision what services to provide and how to design them (Saelens, 2004). However, agent technologies have successfully been applied in the conception and modeling of educational environments. The main reasons being that, multi-agent approach applies very well to domains where distance, co-operation among different entities, and integration of different components of software, are critical issues. Multi-agent systems (MAS) allow the modeling of learning as the emergent result of rich and coherent interactions, which occur over time, between human and artificial agents

(Webber.C, Pesty.S, Balacheff.N, 2002). An agent can be a reactive or a more deliberative entity, able to communicate with other agents, solve problems based on a goal-oriented behavior, and act on behalf of a human user. The main advantage of using multi-agent methodology is related to the flexibility resulting from the interactions agents may carry out.

It is clear that although the learning goals of individual learners are the same, the support individual learners need to achieve those goals varies from learner to learner.

This research study intends to fill the gap by analyzing learner support needs of distance learners and to design an online learner support system using agent technologies to provide feedback to the learners basing on their needs.

In many research findings, there is rising need to redesign curricula models that are driven more by learner needs using Web technologies. This requires educators to expand their visions of pedagogy and learning (Selwyn, N., 2010). The learning goals of individual learners are the same, but the support individual learners need to achieve these goals varies from learner to learner. According to AbdellahBennane (2010), the association of MAS and applications of Web technology have created new concerns of how learners should be supported in a connected multi-user system. This has led to scattered or distributed learners who cannot support each other; thus the need to be supported. The support could be in form of: encouragement, administrative procedures such as timely and accurate information, guidance and information, communication to learners', and provision of accurate and clear procedures and access to help when they have problems (Muchiri, 2012).

1.2 Problem definition

However, the University of Nairobi's bachelor of education ICT based distance learners, the feedback they receive is not timely and hence it discourages them and also becomes costly as they have to travel to the University to get information from their lecturers and administration so as to meet their learning objectives.

1.3 Goal

To build a multi-agent system that will be used to identify the individual learner needs of distant learners so as to support them to meet their goals through delivery of the right content.

1.4 Research Objectives

The following were the specific objectives of the study:

1. To classify learner needs in ICT-supported distance learning environments using appropriate models.
2. To research on key characteristics required for MAS to meet the individual needs of learners in ICT-supported distance learning environments
3. To develop an integrated model of learner needs in ICT-supported DE to support learning system adaptation.
4. To evaluate the prototype using the bachelor of education distant learners of the University of Nairobi.

1.5 Justification

A learning needs approach is the best route to convey learners from the starting point to the target situation. Learner needs are approached from two directions; target needs and learning needs. Target needs are defined as “what the learner needs to do in the target situation”.

1.6 Scope and Limitation

This research problem will be based on bachelor of education distance learners of the University of Nairobi. The scope will be limited to learner support services mainly feedback delivery to distant learners while off campus.

1.7 Definition of Important Terms

Learning: Learning is acquiring new, or modifying existing, knowledge, behavior, skills, values, or preferences and may involve synthesizing of different types of information.

Learner needs: These are the skills, knowledge and competence which a learner needs to acquire during the course of their learning.

Distance learning: It is a networked environment where learning activities occur while the instructor and the learner are separated by location and or time.

Distance learners: These are learners enrolled for studies away from the physical university premises using course materials and face-to-face tuition during school holidays.

Effectiveness: Refers to how well the learner support system works to give the desired results. Effectiveness is assessed in terms student learning –efficacy, motivation and satisfaction.

Learner support services: Includes the many forms of assistance that is intended to both remove barriers (situational, institutional, and dispositional) and promote academic success.

Performance: Refers to the academic output of learners in a given study.

Student satisfaction: This is a state felt by a student whose support needs have met or exceeded.

Support needs: These are the additional help that a learner requires to enable them to address barriers which may otherwise prevent them from fulfilling their learning goals. This includes tutoring and teaching, counseling and advising and related services, and administrative activities in service to learners such as admission and registration. In the context of distance education, learner support has taken on special importance because of the separation between learner and educational provider.

Learner support model: Offers an excellent model for incorporating existing learner support services into distance learning programs. Often, students are forced to go to various offices to receive support services—perhaps getting conflicting information and advice in the process. Students in the online environment often have the same experience; they may click from page to page and encounter conflicting information and advice. Instead, the LAAP’s Project Web model offers a framework for planning, organizing, and delivering integrated student services designed from the student’s point of view.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter covers literature review for the whole of the study. The literature review is organized under the following sub headings: overview of learner support in distance education, learner support services, distance education, ICT-supported learning and multi-agent systems.

2.1 Overview of learner support in distance education

Mills (2003) defines learner support as the totality of the provision by an institution to support the learner other than generic teaching materials produced by institutional designers or course producers. It is a universal approach to the provision of non-subject-based support to the individual learner in the context of a study career which operates from the first enquiry to the completion of studies (Phillips, 2003). A learner support service offers guidance, advice and study support as developmental factors in the whole learning process and it aims to identify and remove barriers to learning. Krauth (1999), notes that special needs arise based on distance learners' isolation and the fact that they depend heavily on technology for learning and accessing resources.

Abate (1999) states "think of all the offices on campus, all of the services provided for traditional learners'. All of these should be considered and made available in same fashion for learners studying at a distance.

Learner support is the assistance and guidance that learners are offered beyond the learning materials. This has been overlooked in distance learning systems.

According to LaPadula (2003), learner support is an integral part of the delivery of quality distance education experiences. Learner services are essential for many reasons. They can enhance enrollment, decrease attrition and provide for a well-rounded programme. In addition they ease student adjustment to college, assist their intellectual and personal growth, and contribute to their academic success (Dirr, 1999). For traditional students, support services are readily available on campus. There is usually a student service division that houses such services as admissions, student records, financial aid, registration, library services, bookstore and counseling. These services are assumed to be part of the educational process (Muchiri, 2012). One of the biggest gaps in distance education is the institutions inability to provide time and location-independent access to a complete array of student support services.

In “Beyond the Administrative Core: creative web-based learner services for online learners”, a three-year (2000-2002), project funded by US-Department of Education’s Fund for Improvement of Postsecondary Education, it was found that student services are considered, the most common services that are incorporated into time and location-independent format are those within the administrative core- such as financial aid, admissions, and registrations. Like the traditional campus based learners’, distance learners need to access other support services such as tutoring, academic advisement, personal counseling, career counseling, and library services.

According to Nyondo (1993), a learner support system can be said to have three subsystems in operation, namely: the administrative, the academic and the socio subsystems. The administrative subsystem deals with matters such as early dispatch of materials and marked assignments/tests, provision of time when tutors are available, telephone access, counseling and many others.

The academic subsystem deals with support that is provided within materials or aspects of face-to-face teaching. The socio subsystem deals with matters that pertains to home and community environment such as access to libraries, availability of peers or family members who can help in the studies. According to Muchiri (2012), all the three subsystems should operate effectively; they should operate simultaneously and not disjointedly (p, 33).

The elements to include in learner support system are: personal contact between learners, support agents (people acting in a variety of support roles and with a range of titles), individuals or group, face- to-face or via other means, peer contact, the activity of giving feedback to individuals on their learning, additional materials such as hand books, advice notes or guides, study groups and centers, actual or virtual, access to libraries, laboratories, equipment and communication networks. Muchiri (2012) notes most distance learners, mainly need feedback and encouragement, administrative procedures such as timely and accurate information, guidance and information, communication to both instructor and other learners’, and provision of accurate and clear procedures and access to help when they have problems with registration.

To effectively meet the learning needs of students, teachers need to begin by understanding the needs of the learners, both collectively and as individual students.

Planning instruction that accepts these differences means providing each student with opportunities to selecting support that will maximize learner achievement.

Learner needs assessment offers a good starting point for this planning (European guide; strategies for improving participation in awareness of adult learning, 2012).

Agencies looking to implement a distant learning program need to establish the needs of the learners. Identifying the problem areas is key to incorporating a successful training program (Lindsay Doak, (2013) Strategies for identifying training needs).

2.2 Approaches to needs analysis

Learner needs analysis models include a sociolinguistic model, a systemic approach, a learning-centred approach and a task-based approach.

2.2.1 A sociolinguistic model

Is an influential model for defining the content of purpose-specific language programmes (Munby, 1978). This model can be used to specify valid ‘target situations’ that target communicative competence. A profile of communication needs is presented, comprised of communicative events (e.g. discussing everyday tasks and duties), channel of communication (e.g. face-to-face), setting of communication, main communicator/s, person/s with whom the communicator/s communicate. The learner’s voice should be taken into account.

2.2.2 A systemic approach

Systemic approach is used to identify the needs of adults learning a foreign language. This approach shows a distinct concern for learners. They are the center of attention, and their ‘present situations’ are thoroughly investigated. The emergent nature of learner needs is also taken into account.. According to Richterich & Chancerel (1977) it is important to use more than one or two data collection methods for needs analysis such as surveys, interviews and attitude scales. Although this approach has not received much criticism, two concerns should be raised: lack of attention to learners’ real-world needs and over-reliance on learners’ perceptions of their needs. Course designers should approach real-world learner needs both in terms of the target situation.

2.2.3 A learning-centered approach

Hutchinson & Waters (1987), suggest that a learning needs approach is the best route to convey learners from the starting point to the target situation. Learner needs are approached from two directions; target needs and learning needs. Target needs are defined as “what the learner needs to do in the target situation” Similar to the systemic approach, Hutchinson & Waters (1987) recommend that needs analysis should be checked constantly.

This should make use of multiple methods of data collection such as interviews, observation, and informal consultations with sponsors, learners and others involved – to deal with the complexity of target needs.

2.2.4 Learner-centred approaches

Berwick (1989) and Brindley (1989) contributed to the learner-centred approaches to needs analysis. They suggest three ways to look at learner needs: perceived vs. felt needs; product vs. process oriented interpretations; and objective vs. subjective needs.

‘Perceived needs’ are from the perspective of experts while ‘felt needs’ are from the perspective of learners (Berwick, 1989). In the product-oriented interpretation, learner needs are viewed as the support that learners require in target situations. In the process-oriented interpretation, the focus is on how individuals respond to their learning situation, involving affective and cognitive variables which affect learning.

2.3 Distant learning

In this study, an online, distance learning environment signifies a networked environment where learning activities occur while the instructor and the learner are separated by location and/or time. The advent of technology provides opportunities for more interactive and flexible distance learning program to be developed. Traditional face-to-face learning and print based distance learning programs have experienced face lifts and adaptations to the web. Thus carrying out a needs assessment on the learners entails more than just their academic background and reasons for pursuing their studies. Online learning requires the learners to move from dependency to achieving self- direction and personal control over their learning. In order to sustain such transition, an in depth analysis of the learners' needs is required.

Integrating multiple intelligent agents into distance learning environments may help to support distance learners (Zhou, Wu, & Zhang, 2005).

Learning support elements are defined as the elements in a learning environment that aid the development of new knowledge, skills and attitudes when the individual interacts with information and the environment. What benefit the learners in their learning environment should emerge from their own needs and perspectives.

In web-based educational systems, the structure of learning domain and content are usually presented in the static way, without taking into account the learners' goals, their ability, and without interactivity, meaning that there is less opportunity for receiving feedback from the instructor or administrator when learners need support (Ahmad Baylari, & G.L.A. Montazer, 2008). By considering individual learner needs and interactivity, there will be increase in quality of learning. The crucial interaction between learner and instructor, as a domain specialist has impact on increasing learners' motivation to the course, and acceleration of interest to the presented contents. However, lack of learners to get the right feedback and especially one that is suitable to them, can be overcome by use of ICT to support the learning process.

2.4 ICT-Supported distance learning

The *Information and Communication Technologies* (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video conferencing and distance learning (Raju,2008).When such technologies are used for educational purposes, such as to support and improve the learning process and to develop learning environments, ICT can be considered as a subfield of Educational Technology.

ICT can assist learners to learn more effectively. It has changed the way people communicate, learn and conduct business. It helps in meeting developmental challenges in many ways. ICT- supported distance learning is a valuable tool (Jung et al., 2010).

In everyday living (life) people seek specific knowledge and skills or services, when and where they need it. ICT makes it available and accessible just-in-time information and knowledge and provides opportunities for continuing and life-long learning.

“Just-in-time learning means acquisition of knowledge and skills as they are needed. It is driven by each learner’s need and the feedback can be customized.

2.5 Multi-Agent concept and approach

An agent is a component of software or hardware, which are capable of acting exactly in order to accomplish tasks on behalf of their users. Agents exhibit the following characteristics: autonomy, reactivity, proactivity, social ability, veracity, benevolence, rationality, learning/adaptation and have distinct personality, behavior, name and role (Georgini et al, 2001). The agents in a system autonomously plan and pursue their actions and sub-goals to cooperate, and coordinate to respond flexibly and intelligently to dynamic and unpredictable situations. There is a wide range of existing application domains that are making use of the agent paradigm to develop agent-based systems, for example, in software technology, robotics, and complex systems (Taghezout *et al.*, 2009).

Multi-Agent system (MAS) is an organization of coordinated autonomous agents which interact in order to achieve common goals. The major potential in multi-agent systems relate to the ability of agent systems to support personalized and informal learning. Online learning environment has a lot of potential to support informal learning, because in a decentralized agent system, there is no need for a central authority to coordinate collaborations and learning activities (Bentivoglio *et al.*, 2010).

The introduction of concepts such as (MAS) allowed web technology to improve the process of modeling and designing for distance learning (AbdellahBennane, 2010). The ubiquitous learning environment provides an interoperable, pervasive, and seamless learning architecture to connect, integrate, and share three major dimensions of learning resources: learning collaborators, learning contents, and learning services (Sung, 2009). The learner voice is a crucial aspect in promoting learning and so it requires listening to learners' opinions and involving them in planning. When considered it can help one to recognize and accommodate learners' individual needs.

In order to deal with these new expectations, architectures based on agent technologies have been quite successfully applied in the conception and modeling of educational environments.

The main reasons for that are related to the fact that the multi-agent approach applies very well to domains where distance, co-operation among different entities, and

integration of different components of software, are critical issues. Multi-agent systems (MAS) allow the modeling of learning as the emergent result of rich and coherent interactions, which occur over time, between human and artificial agents (Webber.C, Pesty.S & Balacheff.N, 2002).

Multi-Agents being open source are therefore able to operate in multiple platforms continuously monitoring what learners need.

2.6 Learner needs models.

AbdellahBennane (2010): Tutoring multi-agent system from experience.

Tutoring systems are complex and they offer a variety of pedagogical software as course modules, exercises, simulators, systems online or offline, for single user or multi-user. This complexity motivated new forms and approaches to the design and the modeling. Studies and research in this field introduce emergent concepts that allow the tutoring system to interact efficiently with potential users, by enhancing ergonomic service, performing response time and allowing better adaptability. The introduction of concepts such as multi-agent systems (MAS) allowed web technology to improve the process of modeling and designing for distance learning, and thus offer convincing solutions.

Eliane et al., 2007: proposed a group management specification and execution method that seeks a compromise between simple course design and complex adaptive group interaction. This is achieved through an authoring method that proposes predefined scenarios to the author. These scenarios already include complex learning interaction protocols in which student and group models use and updates are automatically included. The method adopts ontologies to represent domain and student models, and object Petri nets to specify the group interaction protocols. During execution, the method is supported by a multi-agent architecture.

Loana et al., 2008: presents a model for an adaptive multi-agent system - ACTIVITIES system - for dynamic routing of the learning activities' tasks of a learning environment, based on the adaptive wasp colonies behaviour. The presented model allows the assignment of activities taking into account the qualifications of students, their experience and the complexity of tasks already performed. The system is changing dynamically, because both the type of activities and the students involved in the system change. The ACTIVITIES system is part of the TUTOR subsystem of the DANTE project - Socio-Cultural Models implemented through multi-agent architecture for e-

learning. DANTE has as main objective the development of a model for the virtual education system, student centered, that facilitates the learning through collaboration as a form of social interaction.

Safiye (2005): suggested agent systems with intelligence and adaptability properties in distance learning environment. The suggested system has flexible, agile, intelligence and cooperation features. System components are teachers, learners, and resources. Inter component relations are modeled and reviewed by using the Petri net method.

Agent technology is a promising approach that addresses the challenges of modern day educational environments, influenced enormously by advanced information and Internet technologies. It has received great recognition in quite a lot of educational and training computer-based activities. Consequently agents as guides, information assistants, architectural solution, help systems in virtual environments and interactive learning environments properties used in distance learning environment.

Asma and Nadim (2008): Argumentation and dialogue play an important role in promoting successful E-learning activities. Usually, students/learners need to interact with a learning facilitator at some point, in order to ask for clarification, obtain guidance and explanations. A successful E-learning model is expected to provide the E-Tutor with an insight of what learners need and learners with the knowledge, experiences and insights which they need to achieve their learning objectives. The adaptive role of an E-Tutor is essential to learning because E-resources, such as online databases and/or World Wide Web resources are not often able to satisfactorily address a particular group or individual's learning requirement. Therefore, an E-Tutor has to avail the learner timely access to what he/she needs and can understand.

The efficient and effective communication of knowledge, experiences and insights between entities, such as tutor, student and/or student groups, is a prerequisite for successful education.

A successful E-learning model includes providing the E-Tutor with an insight of what learners need. It also provides learners with the knowledge, experiences and insights which they need to achieve their learning objectives.

ALLEGRO (Viccari, 2007): is an intelligent environment that allows offering an individualized learning to the manner of CSCL (computer Supported Collaborative Learning). The use of MAS offers ALLEGRO autonomy, flexibility and adaptability.

ALLEGRO is based on three theories of learning: behaviorism, cognitivism and historic social. In the environment ALLEGRO, has six agents:

- 1) Tutor who guides the learning process decides what action to teach, how and when;
- 2) Student model allows maintaining the learning student model;
- 3) Interface, is the bridge between the user and the artificial agents;
- 4) Expert manages the content specific purpose of learning teaching;
- 5) Diagnosis is responsible for selecting and classifying the knowledge level of the learner;
- 6) Collaboration, at the request of the tutor agent, it seeks other learners who are interested in the same subject in order to establish synchronous or asynchronous collaborative communications.

2.7 Learner support needs models

According to Lewis and Spencer (1986), the key roles of manager/teacher should be identified and included in the open learning schemes when supporting distance learners. These involve services such as informing, advising, guiding, tutoring and counseling. These services may involve any one of the following activities: communicating, facilitation, feedback, reassuring, listening, inspiring, valuing and encouraging.

2.7.1 Learner centered model (LAAP MODEL)

Student Services for Online Learners

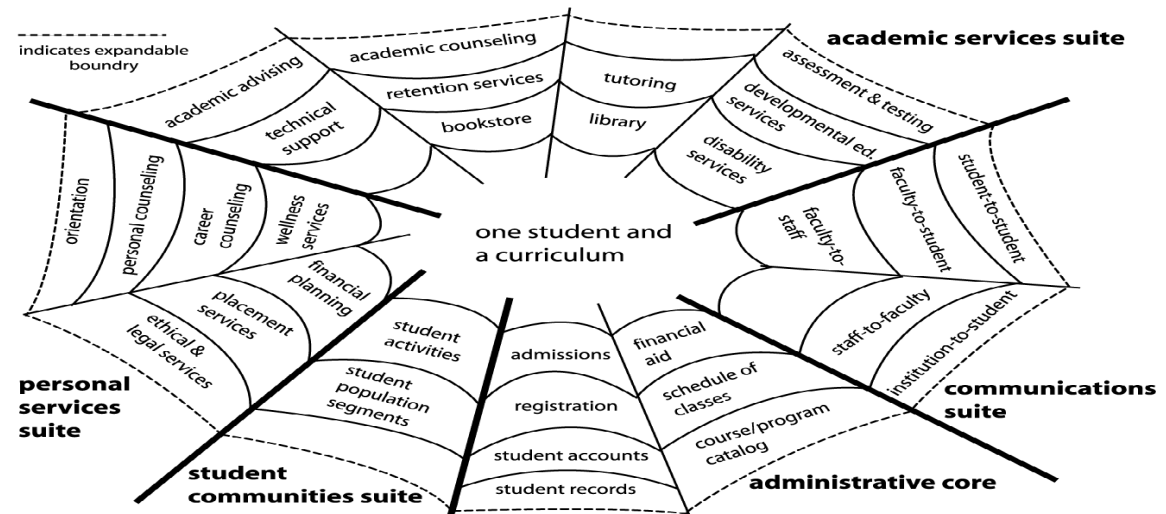


Figure 1: Learner centered model

The Web provides an opportunity to deliver integrated student services designed from the student's point of view.

2.7.2 Lewis and Spencer model.

Lewis and Spencer (1986), include the identification of the key roles of managers/teachers in open learning schemes when supporting learners.

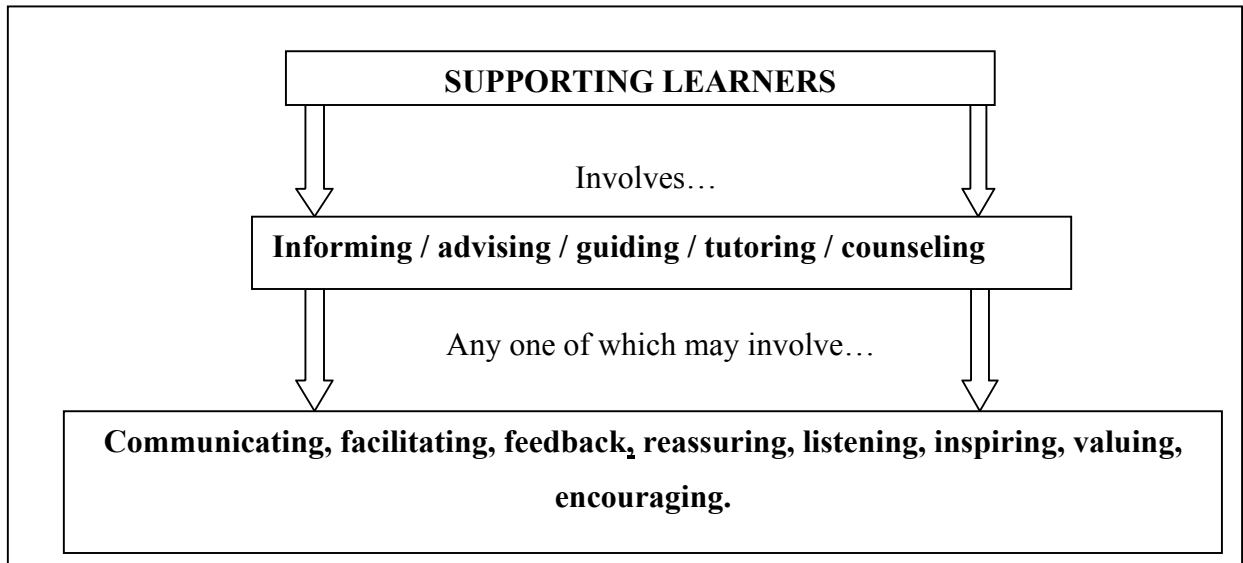


Figure 2: Lewis and Spencer model

2.8 Proposed solution

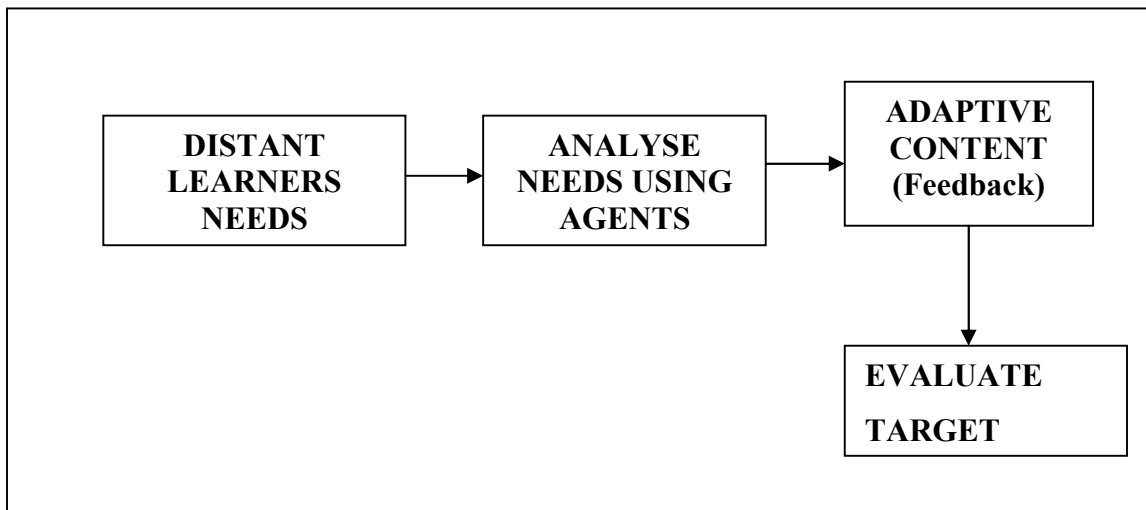


Figure 3: Proposed solution

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter will look at the methodology that was used, illustrating in detail how they were used in achieving the objectives of the study.

3.1 Requirements analysis Methodology

By examining the general domain of ICT- learner support services, this research seeks to meet the needs of the distance learners' by providing feedback as informed by an initial research on learner needs. The characteristics of distance learners make them unique as compared to other learners in the traditional learning environment where learners get direct feedback on whatever they need. The promotional and descriptive materials for distance learners should clearly articulate the benefits learners will derive in terms of learning effectiveness, ease of use, etc. in particular promotional materials should provide learners with clear, complete and timely information about:

1. Availability of academic services such as counseling, advising, tutoring and placement, feedback on assignments/tests etc.
2. Performance expectations concerning datelines, study time requirements and attendance.
3. When, where and how learner/instructor interaction takes place (face-to-face) meetings, residential events, telephone etc.

3.2 Initial Study

This was conducted in order to gain some background data on the intended responses and also to gain more information from the distant learners on whether they were getting feedback from the University, the mode of feedback delivery used, to support their learning and the challenges they were facing. The researcher achieved this through the use of two data collection instruments: interviews and a questionnaire. The questionnaire required participants to provide background data on whether they were receiving feedback, the type of feedback, the mode of feedback delivery, and if the feedback was timely to support them so as to achieve their learning objectives. The reason behind the initial study was to determine the system requirements from the learners.

3.2.1 The effect of feedback on learners

The feedback from 40% of the respondents showed that feedback was motivating, 30% were neutral because they had not received any feedback, while another 30% were of the view that it was not motivating.

Category	Motivating	Neutral	Not motivating	Total
Population	8	6	6	20

Table 1: Learner motivation from feedback

On feedback being helpful to them, 60% agreed while 30% were neutral because they had not received any feedback to be able to rate it as either helpful or not.

Category	Helpful	Neutral	Not Helpful	Total
Population	12	6	2	20

Table 2: Helpfulness of feedback

On feedback being informative, 75% agreed that feedback was quite informative to them while 25% were neutral as they had not received any feedback to be able to rate it.

Category	Informative	Neutral	Not Informative	Total
Population	15	5	0	20

Table 3: Discouraging effect of feedback

On feedback being discouraging, 20% disagreed with that statement implying that most of them agreed that feedback was quite helpful to them.

Category	Discouraging	Neutral	Not Discouraging	Total
Population	2	2	16	20

Table 4: Effect of feedback

3.2.2 Feedback communication

The feedback from 85% of the respondents showed that they were receiving feedback from the university, while 15% said that they had hardly received any feedback.

Category	Receiving Feedback	Not Receiving feedback	Total
Population	17	3	20

Table 5: Feedback communication to learner

3.2.3 Timeliness of the feedback

However, though 95% of the respondents noted that though the feedback was motivating, helpful and informative and like good advice, it was not delivered on time.

There was delay, especially on examination results and fees updates which ended up inconveniencing the learners leading to time wastage and discouragement.

Category	Timely feedback	Feedback not Timely	Total
Population	1	19	20

Table 6: Timeliness of feedback

3.2.4 Mode of receiving feedback from the university

The response from 85% of the distant learners showed that they received feedback from the university through e-mails, website and mobile phone.

3.2.5 Effect of the feedback on their learning

The feedback from 95% of the learners showed that the feedback that they received was very helpful to the learning process.

3.2.6 Clarification of information

On clarification of information send, 65% said that they wanted the information posted on the website clarified. This could be done by phone call or through sending short messages (sms) by phone or by email.

Clarification/Category	Email	SMS	Phone call	Total
Population	13	6	1	20

Table 7: Clarification of information

3.2.7 Feedback required by distant learners

On the feedback required by the learners, 100% of the learners noted that they required feedback on: examination results, study schedules, time tables, study centre meetings, fees adjustments, assignments and assignment results and residential areas.

They noted that most of them were forced to travel to the main campus to get information on the areas mentioned; this lead to time wastage and increased cost on the side of the student hence straining the resources available.

3.2.8 Feedback delivery mode

On the mode of receiving the feedback, 75% wish to receive feedback through emails, 15% through sms and 10% through phone call.

Feedback delivery/Category	Emails	SMS	Phone call	Total
Population	15	3	2	20

Table 8: Feedback delivery mode

From the analysis of 20 samples, it was found that all distant learners needed feedback. However, the needs were different from one learner to another, hence the need to design a system that can analyze, classify and meet individual learner needs by providing timely feedback to support the learning process. Also it was noted that most distant learners needed timely feedback.

Most of them were not happy with the feedback they were receiving because it was not timely and in some cases it was costly as it involved the learners moving from one point to another to look for the feedback, hence time consuming.

The objective of the questionnaire was to find out their feeling about feedback, the areas they needed feedback on, the mode of feedback transmission and the type of feedback (administrative and academic) they require.

3.3 System Development Methodology

The system development methodology used was Agile development methodology. This methodology was preferred because it is iterative and incremental and so allows the assessment of the projects direction throughout the development lifecycle. The methodology also supports addition of features to a system incrementally which is

important especially when dealing with web applications. The overall model of the system was created and the features were added incrementally until all the objectives were met.

Since the changes were met to different features as the system was being developed, the Feature Driven Development (FDD), a variant of agile methodology was used. FDD is a model – driven, short – iteration process.

It begins by establishing the overall model shape then continues with “design by feature, build by feature” iterations. The features are small and useful in the eyes of the client. FDD will allow for features to be defined from the users (learners) point of view.

Agile development methodology was found to be a good option to implement the proposed solution in an incremental approach through an iterative approach.

The methodology basically results to inspection and adoption approach which greatly reduces both the development cost and time. For each iteration there will be an output, a component of the proposed solution that will be evaluated against the requirements.

Agile development methodology was followed iteratively through the following steps:

- Requirements analysis
- Architecture and design (features design).
- Development and evaluation of the features.

The steps will be carried out as a continuous and iterative process as defined in the agile development methodology.

3.3.1 Drawbacks of the Agile methodology

- The iteration if not controlled can lead to a never ending incremental loop.
- Requires specialized knowledge and expertise.

3.3.2 System Requirements

From the initial study analysis the system requirements for the feedback system were found to be:

- i. Provide timely feedback to distant learners.
- ii. Provide feedback on: study schedules, fees updates, meetings, examinations, timetables, and residential information.

- iii. Provide academic feedback: assignments/marks, inquiries from lectures.
- iv. Provide a means of information clarification from administration.
- v. Allow learners to interact with course lecturers and administration.

3.4 Architectural Design

This stage was concerned with the understanding of the problem by studying an organizational setting and the output was a feedback model which included the agents, the stakeholders (i.e. learners, lecturers and administrators).

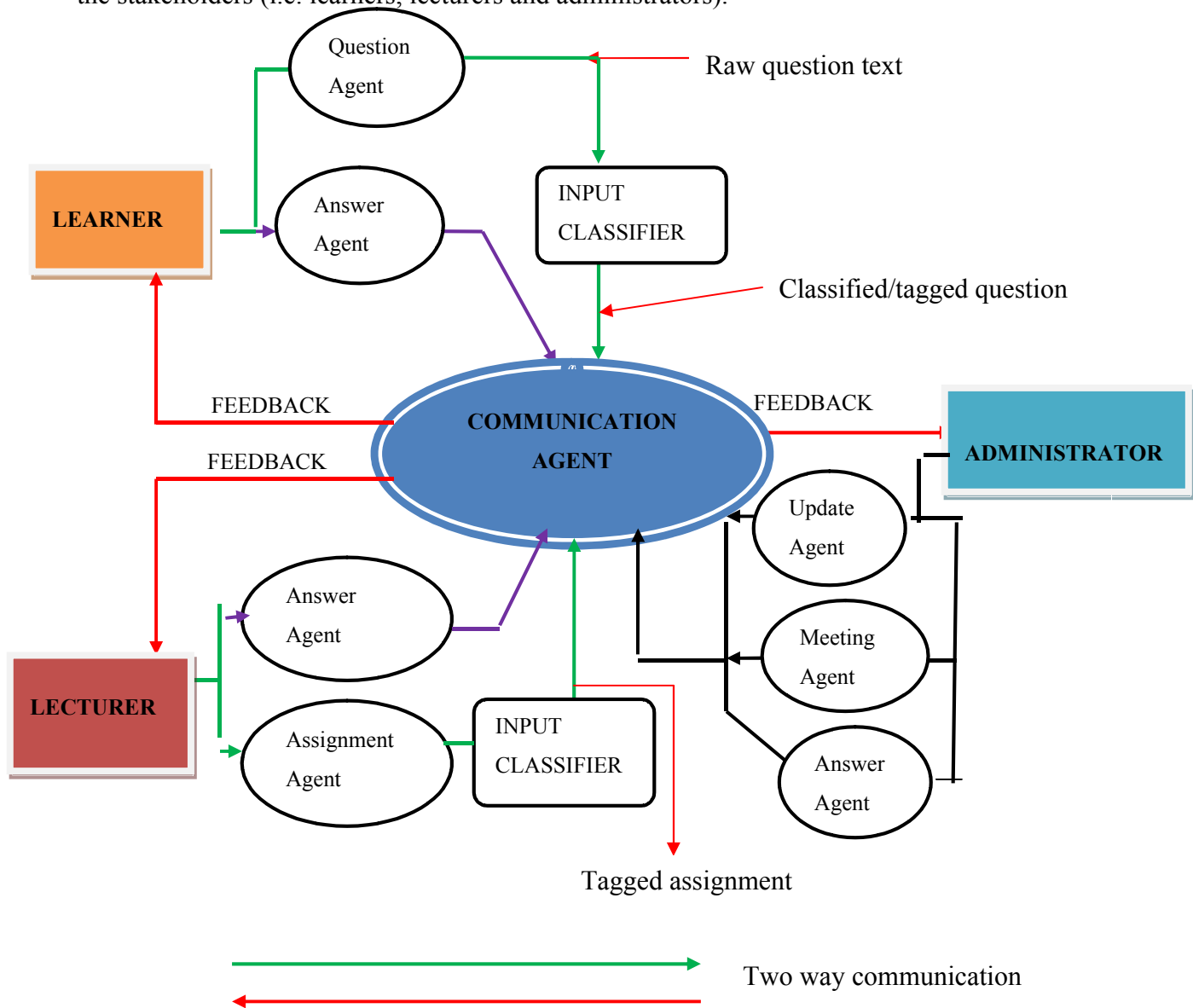


Figure 4: The feedback agent model

The six agents in the feedback system were namely: communication agent (or coordinator agent), the updates agent, the meeting agent, the question agent, the answer agent and the assignment agent.

1) **The Communication Agent**

It's the master agent in the system that coordinates all the other agents in the system. It coordinates communication of information to the different stakeholders in the system i.e. students, lecturers and administration.

This agent sends out alerts (feedback) in the form of emails, sms and phone call requests. The default alert is email. The other two can be sent only upon request by the learner. Phone call requests can only be used for clarification of information and only by the administrator.

2) **The Updates Agent**

It receives the Updates from the user agent; it wraps it up into updates object and then sends it over to the Communication Agent.

3) **The Meeting Agent**

It creates a meeting and wraps it up into a meeting object and with a tag; who it is intended for and then sends it over to the Communication agent to route to the intended persons.

4) **The Assignment Agent**

The lecturer creates an assignment and then the assignment agent takes the assignment wraps it up into an assignment object with a tag and forwards to the communication agent to forward to the intended recipient.

5) **The Question Agent**

This agent is used by students to create and post questions to the lecturers or fellow students. It then classifies the question using the classifier- Naïve Bayes classifier Model basing on natural language processing (NLP). It then passes the question to the communications agent.

6) **The Answer Agent**

It gets the answer created, wraps it over into an answer object and then sends it over to the person who asked the question.

3.5 Research Design

The researcher used mixed method design for this study. Mixed method design was used because it focuses on collecting, analyzing and mixing both qualitative and quantitative data in a single study or series of studies.

3.5.1 Target Population

The study covered bachelor of education ICT based distant learners of the University of Nairobi from Migori, Homabay and Kakamega Counties.

3.5.2 Sampling Methodology

Purposive sampling/judgmental sampling was used because the target population was specific and of limited availability. The distant learners are scattered all over the counties selected and so makes their availability quite limited.

3.5.3 Sample Size

The researcher targeted about 307 learners. 30 learners were sampled out of the target population. Of the targeted 30, 21 completed their questionnaires and submitted while 9 never submitted.

3.5.4 System Evaluation

The evaluation of the feedback system is important for all actors involved in their development and use. The distance learners in an institution implementing distance learning programme need to assess the benefits of using the system in comparison to the traditional way of getting feedback while they are off campus. The outcome was to provide information whether it will meet the distance learner needs in a distance learning environment (AACSB International, 2007). The results of an assessment process should provide information which can be used to determine whether or not intended objectives were achieved.

3.5.5 Evaluation Instrument

To evaluate the impact of the prototype, the bachelor of education ICT-based distance learners of the University of Nairobi were used. The university has distant learners in different regions in Kenya.

The feedback system was hosted by python anywhere so that it could be accessed by the learners easily. The learners used the system for a period of two weeks. At the end of the two weeks, they were required to evaluate the system based on usability and functionality.

3.5.6 Data Collection

The main data collection instrument used was a questionnaire. The questions were based on an inventory of questions developed by the Presences research working group at the Technische University Eindhoven, Netherlands. The questionnaire had two sections; the first section had a set of questions related to usability. The second section had a set of questions relating to functionality of the prototype.

A 5 – point Likert type scale was adopted for the second and third sections of the questionnaire the first section of the questionnaire participants were required to respond with “Yes or No”.

The questionnaire was used because of two reasons:

- (a) It is an effective small-scale research tool, and
- (b) Because "the knowledge needed is controlled by the questions, therefore it affords a good deal of precision and clarity" (McDonough & McDonough, 1997).

3.6 Questionnaire Pretesting

This is a very important part of the questionnaire construction. It involves testing the questionnaire in conditions similar as possible to the research but not in order to report results but rather to check for glitches in wording of the questions and lack of clarity of instructions.

Pretesting allowed the researcher to identify anything that could have impeded the instrument ability to collect data in an economical and systematic fashion. The researcher carried out a pilot study to pretest the validity of the questionnaire.

The pilot study used mixed method research design and was done with four participants, three learners and one education expert.

The problems that were identified with the questions included confusion with the overall meaning of a question, as well as misinterpretation of individual terms.

This allowed for revision and modification of the questionnaire thereby enhancing validity of the instrument .The data collected during this instrument pre-testing phase was not included as part of the data used in the actual study.

CHAPTER FOUR: SYSTEM DESIGN AND IMPLEMENTATION

4.1 The System Design Process

The prototype development methodology used the iterative feature driven development (FDD) a variant of the agile software development methodology. The design process involved first the development of an overall model for the prototype (refer to Fig 3.1). The feature development methodology requires that a feature list be developed after the overall model is created hence the next step was identifying a set of features that are required in order to achieve the set objectives of this study. The overall model was broken down to several features based on the four objectives of the study as illustrated below:

No.	Objective	Feature
1.	Developed a classifier that enables the learner to capture learner needs(questions) and classify them into appropriate categories	A Naïve Bayes classifier
2.	To research on key characteristics of MAS in order to meet individual needs of learners.	Achieved through the development of agents.
3.	Develop an integrated MAS system to analyze learner needs in ICT-supported distant learner environment.	System developed.
4.	System evaluation	Pre and post evaluation

Table 9: Model breakdown into features

4.2 Tools and Techniques

The data analysis task classification is where a model or classifier is constructed to predict categories or labels based on a set of attributes. There are two main approaches to classification: supervised learning and unsupervised learning. In supervised learning, the categories that data is assigned to are known before computation. So they are being used in order to 'learn' the parameters that are really significant for those Clusters. However, in unsupervised learning datasets are assigned to segments, without the clusters being known. This research used a classification algorithm Naïve Bayes Classifier to predict the label for a given input sentence. Naïve Bayes classifier is a supervised learning classification technique.

4.2.1 Python

The task of building the classifier was carried out using Python as a programming language. The Python programming language is a dynamically-typed, object-oriented interpreted language. Although, its primary strength lies in the ease with which it allows a programmer to rapidly prototype a project, its powerful and mature set of standard libraries make it a great fit for large-scale production-level software engineering projects as well. Python has a very shallow learning curve and is an excellent online learning resource (semantic bible 2008).

4.2.2 Natural Language Toolkit (NLTK)

Although Python already has most of the functionality needed to perform simple NLP tasks, it's still not powerful enough for most standard NLP tasks. This is where the Natural Language Toolkit (NLTK) comes in. NLTK is a collection of modules and corpora, released under an open source license that allows students to learn and conduct research in NLP. The most important advantage of using NLTK is that it is entirely self-contained. Not only does it provide convenient functions and wrappers that can be used as building blocks for common NLP tasks, but it also provides raw and pre-processed versions of standard corpora used in NLP literature and courses. According to bird et al is of the view that NLTK was designed with four primary goals in mind; Simplicity, Consistency, extensibility, Modularity.

4.2.3 Naïve Bayes Classifier

Naïve Bayes classification is based on Bayes theorem. A simple Bayes classification namely the Naïve classifier is comparable in performance with decision tree and neural network classifiers. Naïve Bayes classifiers have also exhibited high accuracy and speed when applied to large database. Naïve Bayes classifier assumes that the effect of an attribute value on a given class is independent of the values of the other attributes. This assumption is called *class conditional independence*. It is made to simplify the computations involved and, in this sense, is considered “naïve”. While applying Naïve Bayes classifier to classify text, each word position in a document is defined as an attribute and the value of that attribute to be the word found in that position.

Naïve Bayes is formalized as the product of the prior probability which is based on previous experience and the likelihood of a given attribute being in a given class, this forms the posterior probability.

To classify an unlabeled example it is just a matter of using the prior probabilities of a given category and multiplying them together. The category which produced the highest probability would be the label/classification for the unlabeled example. Only the words found in the unlabeled example would be looked up in the feature vector.

The following equation would be used to classify an unlabeled example. Given a document d and a class c , where the goal is to predict the probability that the document d belongs to class c .

$$P(c/d) = \text{argmax} (P(d/c).P(c)) \dots \dots \dots (1)$$

4.3 Multiagents (MAS) in the feedback system

After developing the system and testing it, the next step is to implement it in a web based environment so that it can be accessed by the learners in the different geographical regions.

The system was developed using python programming language and Django as a web development framework. This framework was chosen because: it is for perfectionists' i.e. people who need to meet set datelines, it helps built applications easily and it focuses more automating and adheres more on the 'DRY' principle during development hence saving on time.

4.3.1 Question agent implementation

This agent was implemented to create and post questions to lecturers and administration. It then classifies the question using the Naïve Bayes classifier model, tags the question and forwards the question to the communications agent for further action.

4.3.2 Answer agent implementation

This agent was implemented to get answers created by the user agent and forward them to the communications agent for further action.

4.3.3 Meeting agent implementation

This agent was implemented to create a meeting, tag the meeting and then forward the meeting to the communications agent for further action on it.

4.3.4 The communication agent implementation

This agent was implemented to coordinate all other agents in the system. It is the master agent in the feedback system. It coordinates communication of information (academic/

administrative) to the respective user agents (learners, lecturers and administration). This agent interprets the tag on the message and then sends an alert to user agent through email or short message over the phone

4.3.5 The updates agent implementation

This agent was implemented to create updates and forward the update to the communications agent. It's used by the administration to update learners and lecturers on latest happenings in the university, events scheduled changes in fees etc.

4.3.6 The assignment agent implementation

This agent was implemented to be used by lecturers to create assignments for the learners, and subsequent submission of the assignment by the learners to the lecturer. The assignment created is classified by the classifiers into its respective subject, and send to the communications agent for further action on it.

4.4 System Views

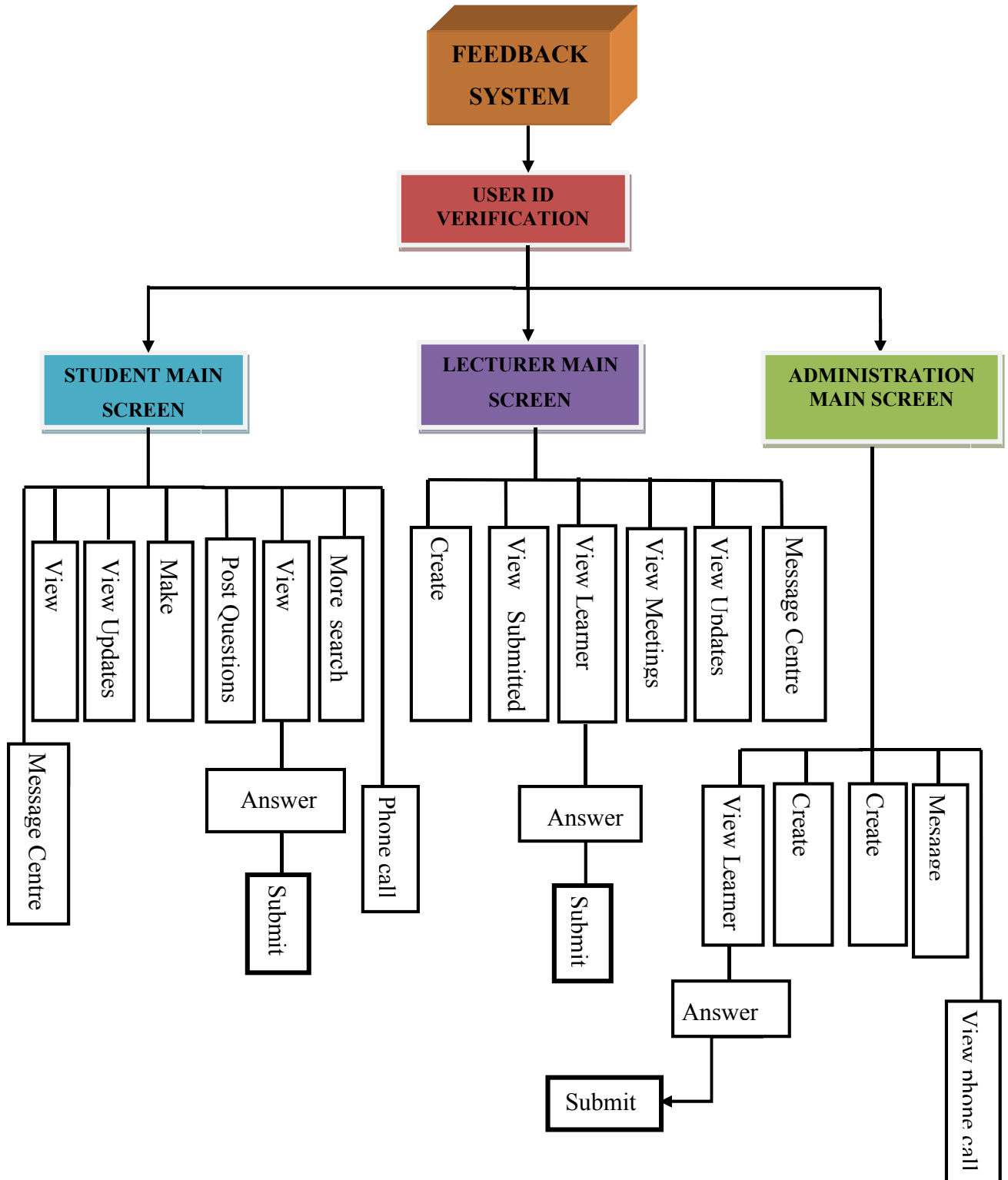


Figure 5: System views

CHAPTER FIVE: RESULTS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter provides the results of the evaluation of the prototype as carried out by bachelor of education ICT-based the distant learners of the University of Nairobi.

The purpose of this study was to examine how distant learners can be supported while off campus by using the feedback system to achieve their objectives. The system was tested against the set overall goal of the study which was to develop a system that can give feedback to distant learners depending on their needs and through the desired mode. Data on actual use of the system was collected over a period of two weeks. A satisfaction survey was then conducted at the end of the evaluation period through a questionnaire.

The questionnaire had two sections. The first section related to usability of the prototype; these were set to evaluate how easy it was to use the prototype with minimal or no training. The second section considered the functionality of the prototype as spelled out by the research objectives that is, was the system able to give feedback to the learners using the agents the developed.

5.1 Evaluation techniques

Both qualitative and quantitative analysis of the data collected was done. The questionnaire had both open ended and closed ended questions hence required a mixed method of analysis. Inductive analysis involved discovering patterns and themes in the data analyzed.

5.2 Evaluation of the prototype results

(a) Usability

No.	Question	Yes	No
1.	Are you getting feedback from the system?	21	0
2.	Was the feedback timely?	19	2
3.	Did you get updates about fees, meetings from the administration?	21	0
4.	Did you receive the feedback through the desired mode?	21	0
5.	Do you have an account on the feedback system?	21	0

21 learners had accounts on the feedback system and were able to receive fees updates, meeting notices through the system.

21 distant learners felt that the feedback received was timely and was received through their individual desired mode.

The system is good as learners can receive timely feedback through it and also through the desired mode.

(b) Functionality.

To determine if the prototype achieved the set overall goal of the research, the questionnaire contained a set of question on the functionality of the prototype, i.e. did it support the distant learners depending on their individual needs (Appendix I).

No.	Question	1	2	3	4	5
1.	Is the site easy to navigate when viewing the menus?	15	4	0	2	0
2.	Is the information on the site clear and well organized?	16	2	1	2	0
3.	Is your area of study covered on the system?	18	1	0	2	0
4.	Would you recommend the other learners to use the system for feedback?	18	2	1	2	0

19 of the distant learners agreed that the site was easy to navigate, while 2 learners disagreed. These learners gave the reason of having poor computer skills necessary to access the system.

18 learners agreed that the information on the system was clear and well organized. Three learners disagreed as they had not interacted with the system in totality.

20 distant learners agreed that the system was good enough to use to support them and would recommend the same to others. 1 learner was neutral while the other 2 disagreed with it.

From the system users it is evident from the results that the system is easy to navigate, has well organized information and can support the distant learners while off campus.

5.3 Discussion

This section discusses the findings of the research study in relation to objectives.

Objective 1

The first objective was to “To classify learner needs in ICT-supported distance learning using appropriate models”. This was achieved through the use a classifier, which classifies learner, needs as academic or non- academic and allows learners to ask questions in their area of specialization and classifies the question into an appropriate subject area.

Objective 2

The second objective was to “To research on key characteristics required for MAS to meet the individual needs of learners in ICT-supported distance learning environment”. This was achieved by using question agent, answer agent, assignment agent, meeting agent, updates agent and communication agent

Objective 3

The third objective was to “Develop an integrated model of learner needs in ICT-supported distance education to support learning system adaptation”. This was achieved through sending alert emails, sms. The default feedback mode is by email. However, those who wish to receive alerts by sms will be charged for that mode of transmission. Phone call requests are made by learners who need further clarification and this is an admin function. Those who request are also to be charged an extra fee on the normal one.

Objective 4

The last objective was to “To evaluate the prototype using the distant learners of the University of Nairobi “This objective was achieved by using a questionnaire. The sampled learners were given a link to the feedback system, to use it for a period of two weeks. They then evaluated the system basing on usability and functionality.

5.4 Achievements

The results discussed above indicate that the prototype was able to achieve the set goal of the study. The study was able to address the limitation of the university in feedback delivery to the distant learners. The feedback was timely and was based on individual learner needs both on delivery mode (email, sms, phone call) and learner needs (i.e. academic/ non-academic needs).

The prototype was able to address the limitations of the university student management system, where the learners receive the feedback via emails only and it's not timely. The admin is at the center of communication ensuring that the information send to the learners is uniform and timely. Since each learner has an account on the system, it ensures that they receive the summary of the alerts send promptly to them.

The prototype was also able to improve of learning process because learners could be able to do assignments and submit them online. The learners can also interact with lecturers by asking them questions and receive the feedback in real time.

Most learners have mobile phones with email configured on them which allows them to receive emails upon being sent. For those learners wishing to get clarification from the administration, an extra component has been inbuilt to allow learners to make phone call requests. Through this the learners can get clarification on any information of interest as individuals.

5.5 Conclusion

The purpose of the study was to build a multi-agent system that will be used to identify the individual learner needs of distance learners so as to support them to meet their learning goals through delivery of the right content.

The research started by pointing out that, the concept of learning needs stems from adult learning theory. Through a process of reflection, the learner identifies deficiencies in knowledge or skills with the aim of meeting these needs through the creation of an action plan (Knowles et al., 2011).

A learner support service offers guidance, advice and study support as developmental factors in the whole learning process and it aims to identify and remove barriers to learning. Krauth (1999), notes that special needs arise based on distance learners' isolation and the fact that they depend heavily on technology for learning and accessing resources.

For traditional students, support services are readily available on campus. There is usually a student service division that houses such services as admissions, student records, financial aid, registration, library services, bookstore and counseling.

Feedback is essential to learning and to sound assessment practice (Brown, 2007). According to Nichol (2007), feedback empowers learners to monitor, manage and take responsibility for their own learning.

The challenge is to provide feedback that learners can access, understand and use to inform their studies and future performance. To achieve this Bout and associate (2010) underscores that feedback should be: Informative and supportive to encourage positivity towards learning, Timely, allowing feedback to be used to inform other learning and work, Frequent and specific enough to guide learners.

Agent technologies have successfully been applied in the conception and modeling of educational environments. The main reasons being that, multi-agent approach applies very well to domains where distance, co-operation among different entities, and integration of different components of software, are critical issues.

Multi-agent systems (MAS) allow the modeling of learning as the emergent result of rich and coherent interactions, which occur over time, between human and artificial agents (Webber.C, Pesty.S, Balacheff.N, 2002).

The study also showed that timely feedback is not being provided to the distant learners hence discouraging them. The feedback should be specific and provided frequently to the learner, to guide the learner and to improve the learning practices.

The researcher developed a prototype (feedback system) that provides an enabling environment for distant learners that can be incorporated in the University students' management system. The prototype is aimed at supporting the learners by delivering prompt, timely and frequent feedback to distant learners. The prototype, used agents to send notification alerts to distant learners through email, sms.

5.6 Recommendations

- i) Distant learners of the University of Nairobi need a feedback system that will provide timely feedback to support them while off campus to communicate to the administration and lecturers so as to meet their learning goals.
- ii) A real time feedback module should therefore be incorporated in the University's students portal to support the distant learners while off campus to provide feedback on study schedules, fees updates, meeting updates, assignments, general enquiries etc.

5.7 Limitations

- i) **Requirement collection:** The study was not able to capture all the University of Nairobi distant learners in Kenya. This was due to the time and cost implications involved.
- ii) **The nature of students:** They were far, busy with work and hence did not have enough time to respond to the questions comprehensively.

5.8 Suggestions for further research

This study limited itself to feedback on academic and administrative sections only. Therefore, there is need to explore on how to use agents to provide feedback on individual counseling/advising of distant learners and procedures.

The study focused only on developing a feedback system to facilitate distant learners get information from the university quickly, seek clarification from the administration on study schedules, Timetables, fees updates, meetings, assignments and residential areas.

These support service enhances the learning as the individual needs of the learners are easily addressed by the system.

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APPENDIX I

Initial study questionnaire

Initial study questionnaire to guide the development of a feedback support system for distant learners.

1. What does feedback feel like?

	Strongly Agree	Agree	Neutral	Strongly Disagree
Motivating				
Helpful				
Like good advice				
Informative				
Discouraging				

2. Are you getting feedback? **Yes** [], **No** []

If yes, through which means?

3. Is the feedback helpful? **Yes** [], **No** []

4. If yes, is the feedback timely? **Yes** [], **No** []

Do you often need clarification given on information given by the existing feedback models? **Yes** [], **No** []

What challenges do you get when trying to clarify the feedback e.g. the source of information not being there 24/7 or over the weekend?

What forms of feedback delivery are you comfortable with?

5. What kinds of feedback would you want more often? List them in order of preference.

6. What kind of feedback would you want in order to perform a task well in case you are stuck (task-specific feedback):

7. Would you want feedback on:

Study schedules? **Yes** [], **No** []

Timetabling? Yes [], No []

Examination results? Yes [], No []

Meetings? Yes [], No []

Fees adjustments? Yes [], No []

Assignments? Yes [], No []

8. Are there some specific types of information you require feedback as an Individual, which some students do not require due to special needs such as:

I am not able to access internet? **Yes** [], **No** []

Poor phone connection? **Yes** [], **No** []

Job demanding? **Yes** [], **No** []

More concrete information? **Yes** [], **No** []

9. In which format do you need information? Text [] Point form []

10. Which mode of information may you want feedback delivered through?

Emails [] Sms [] Phone call []

Evaluation questionnaire

This questionnaire was used to evaluate the usability, functionality of the feedback system and the extent to which it meets the distant learners' needs.

Section I: Personal Information

1. Which course are you pursuing?

2. In terms of computer proficiency, how would you characterize yourself?

A) Just good.

B) Professional

C) Technical expert

(1) Please indicate Yes or No for the following questions:

Issued after the learners had interacted with the system	YES	NO
I used the system and got feedback on the subject that I wanted.	21	0
The feedback I got was timely.	19	2
I got the feedback through the delivery mode that I selected on registration.	18	3
I got feedback on fees updates.	21	0
I have an account on the feedback system	21	0

(2) Please indicate your level of agreement with the following statements regarding the system you have been using

1-Strongly Agree, 2 -Agree, 3-No Opinion, 4-Disagree, 5-Strongly Disagree

	1	2	3	4	5
The site was easy to navigate around when viewing the various menus.	15	4	0	2	0
The content provided by the system meets my needs.	18	1	0	2	0
All subject areas are covered by the system.	15	3	0	2	1
Information on the system is clear and well organized.	16	2	1	2	0
Would you recommend others to use it?	18	2	1	0	0

Summary Comments

Major Strengths.....

.....

Major Weaknesses.....

.....

Suggested features/Updates.....

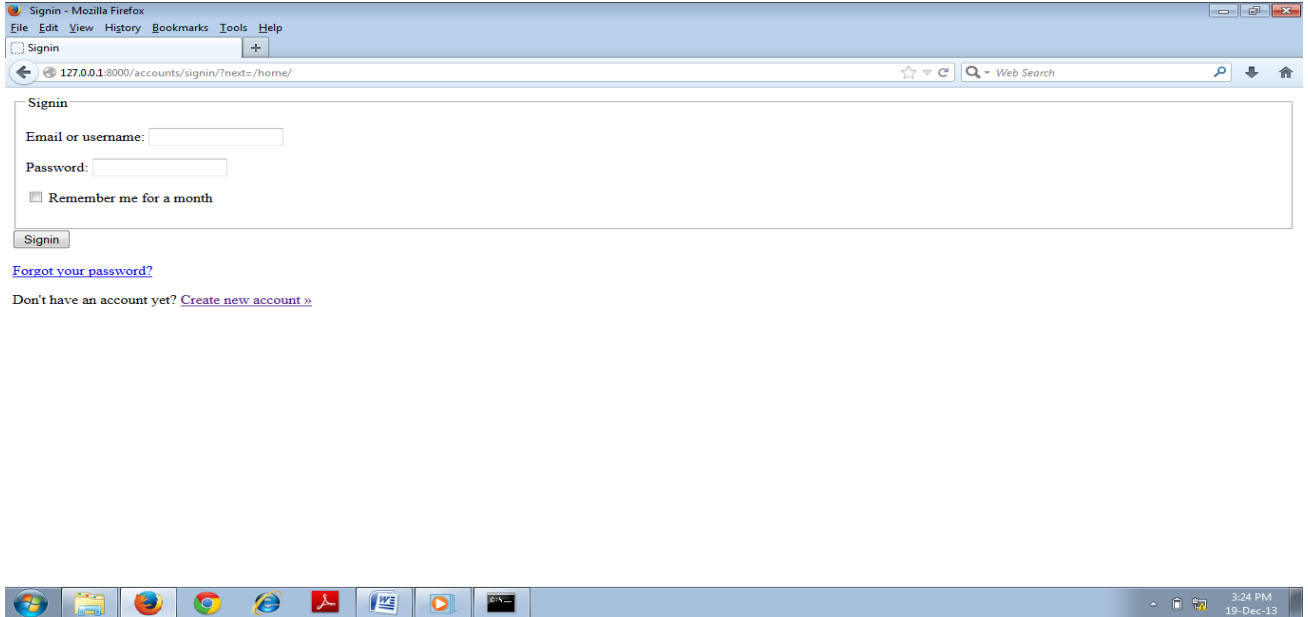
.....

Other Comments.....

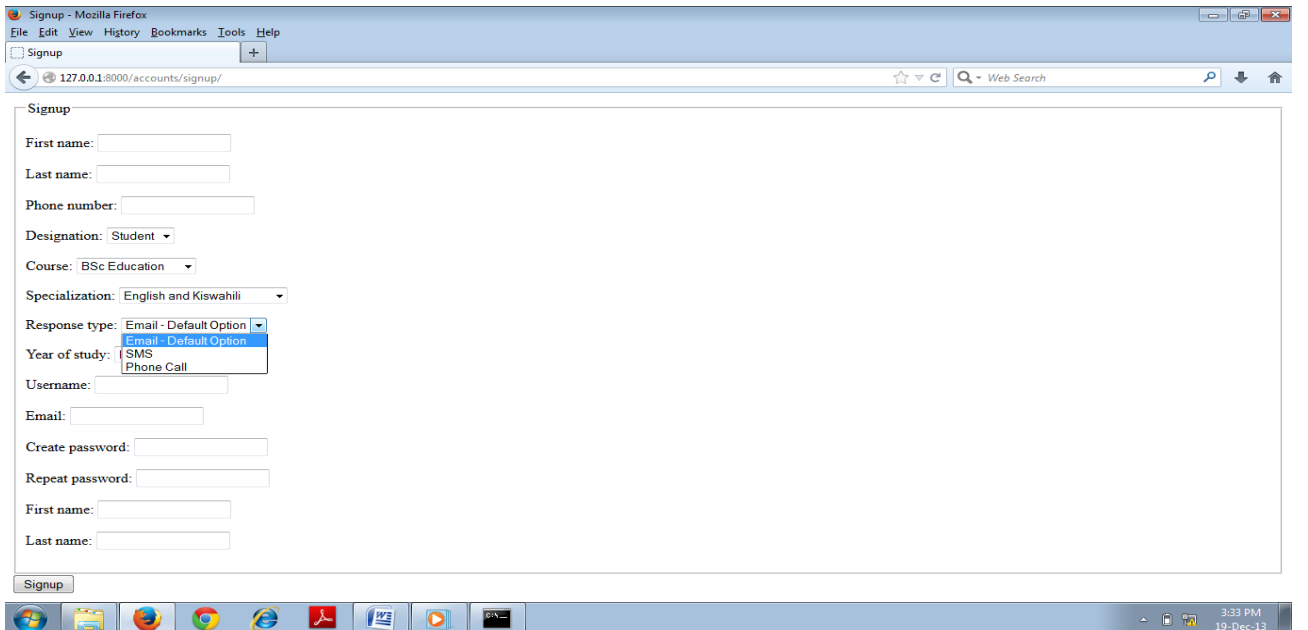
APPENDIX II

SCREEN SHOTS

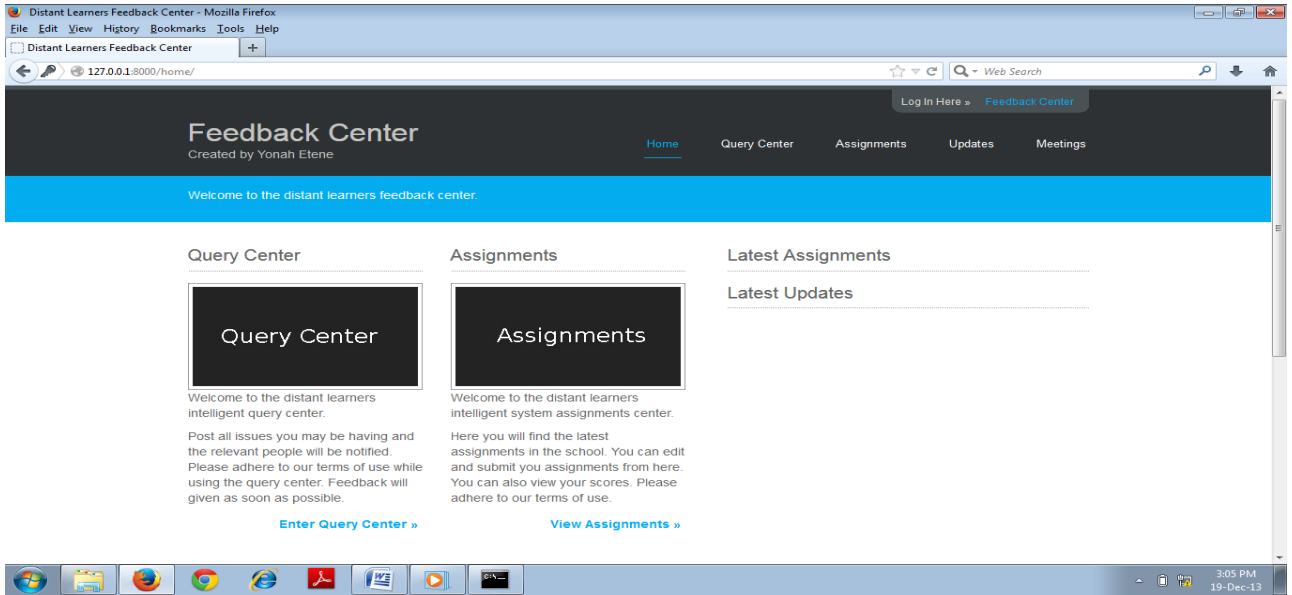
Login screen



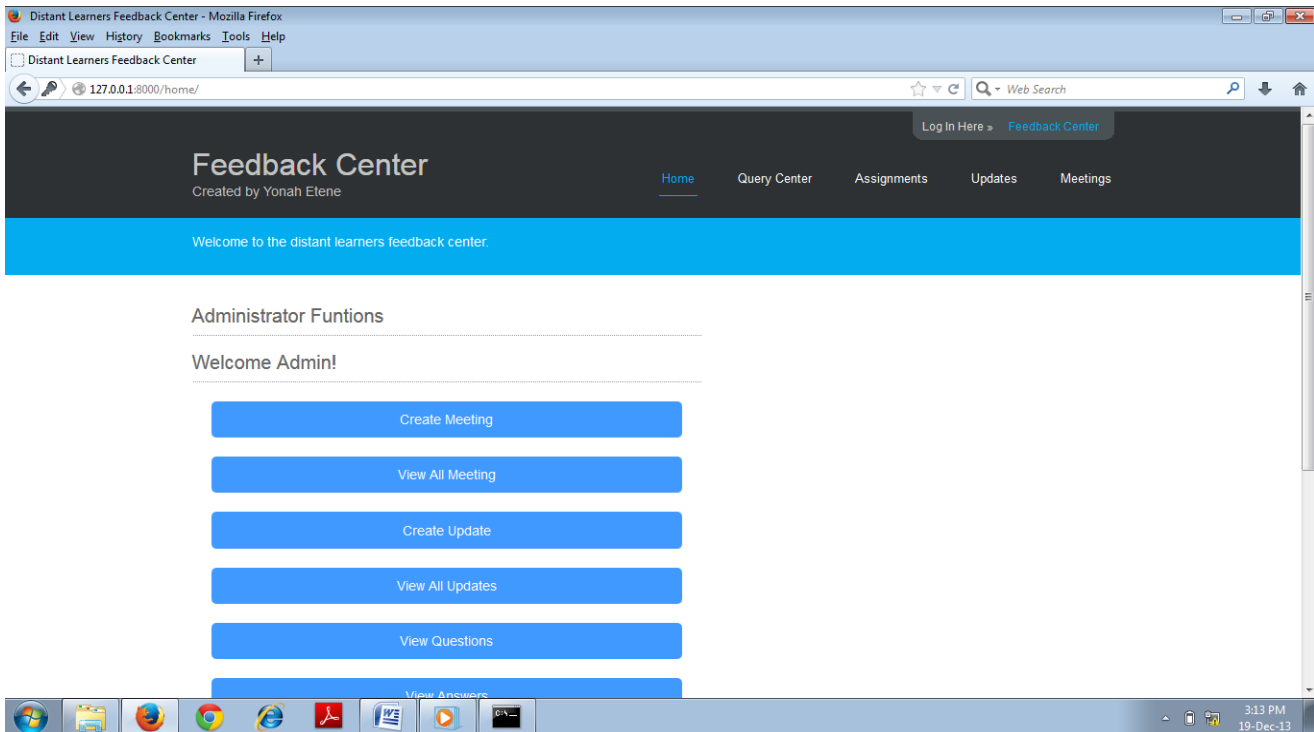
Learner Registration Screen



Learner view Screen



Administrator view Screen



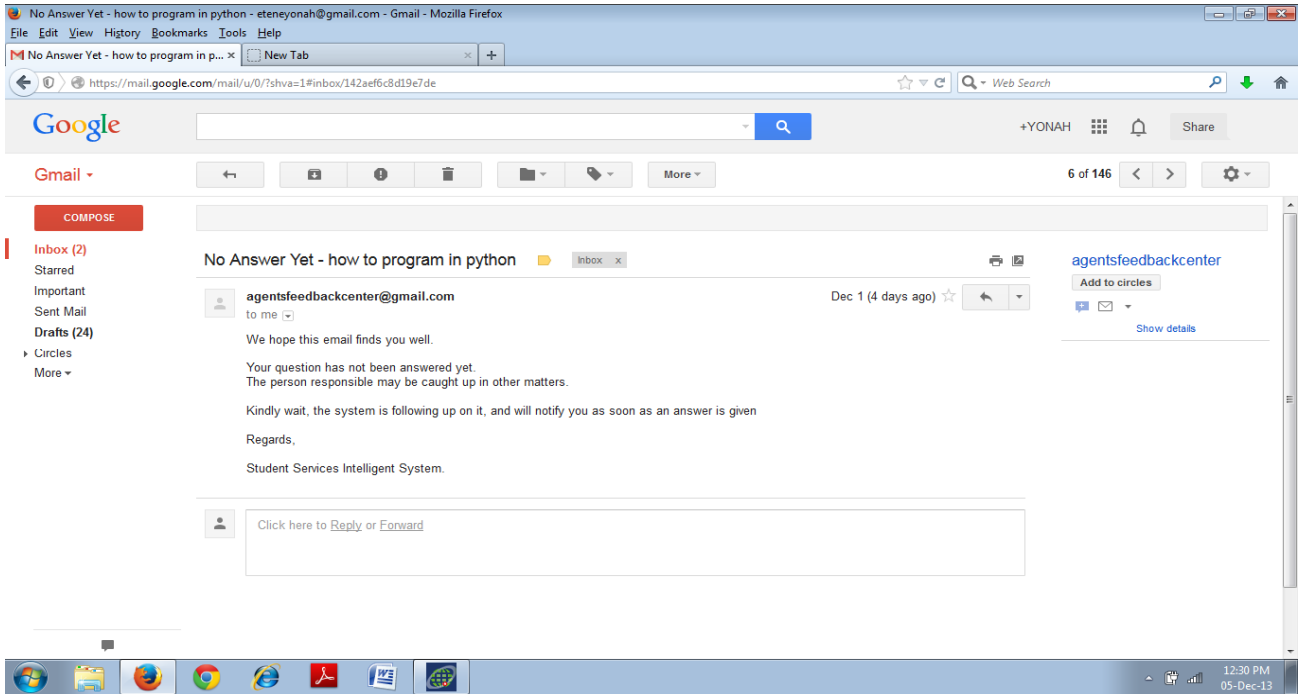
Lecturer view Screen

The screenshot shows the 'Distant Learners Feedback Center' web application. The browser window title is 'Distant Learners Feedback Center - Mozilla Firefox'. The address bar shows the URL '127.0.0.1:8000/home/'. The page header includes a navigation menu with 'Home', 'Query Center', 'Assignments', 'Updates', and 'Meetings'. Below the header, a blue banner reads 'Welcome to the distant learners feedback center'. The main content area is titled 'Lecturer Functions' and 'Welcome Lecturer!'. It features five blue buttons: 'Create Assingment', 'View Submitted Assignments', 'View Meetings', 'View Updates', and 'View Questions'. The Windows taskbar at the bottom shows various application icons and the system clock indicating 3:17 PM on 19-Dec-13.

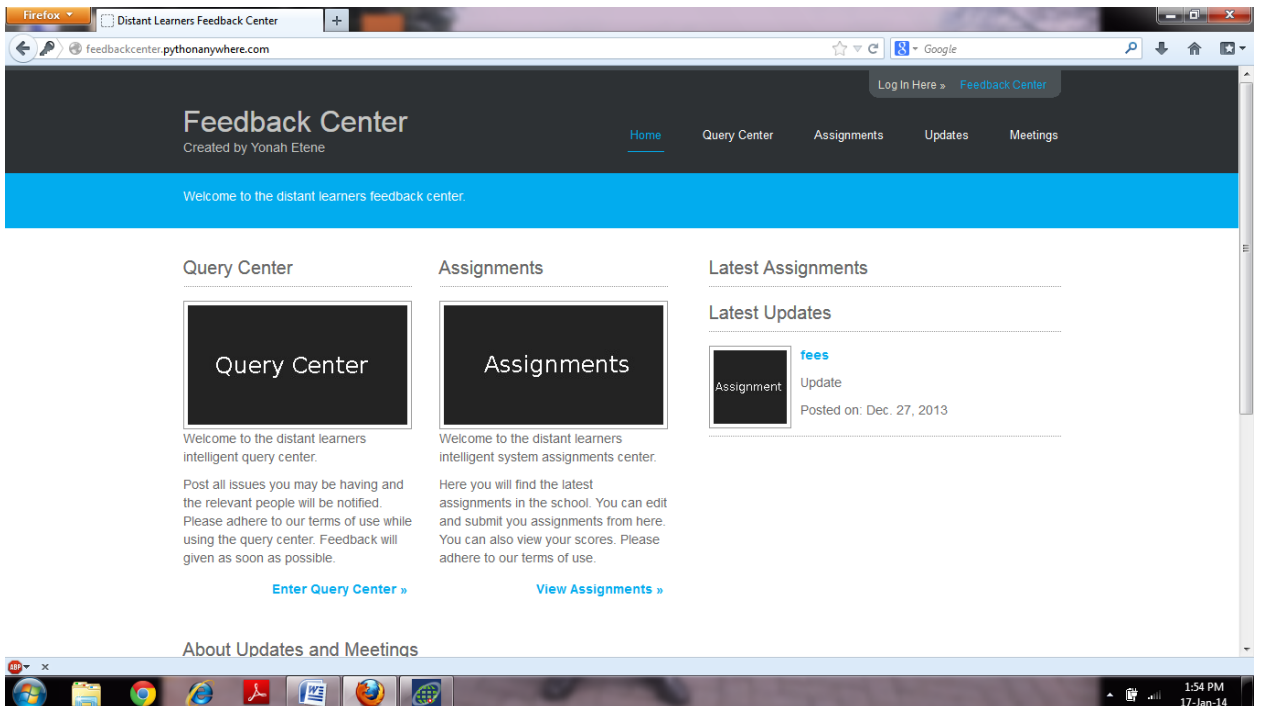
Meeting alert to learner/ lecturer

The screenshot displays a Gmail interface showing a meeting invitation email. The browser window title is 'Meeting Invitation - meeting title - etenyonah@gmail.com - Gmail - Mozilla Firefox'. The email is from 'agentsfeedbackcenter@gmail.com' and is dated 'Dec 1 (4 days ago)'. The body of the email states: 'We hope this email finds you well. A new meeting has been posted on the system. Please purpose to attend. More details about the meeting are summarized below: Date: 2013-12-03, Venue: meeting venue, Main Theme: meeting theme, Description: meeting description. Regards, School Intelligent System.' The email interface includes a left sidebar with navigation options like 'Compose', 'Inbox (2)', 'Starred', 'Important', 'Sent Mail', and 'Drafts (24)'. The right sidebar shows advertisements for 'agentsfeedbackcenter', 'HR Payroll Software', 'Online MBA in \$1850', 'Bachelor in IT Security', and 'Scent Marketing Special'. The Windows taskbar at the bottom shows the system clock at 12:34 PM on 05-Dec-13.

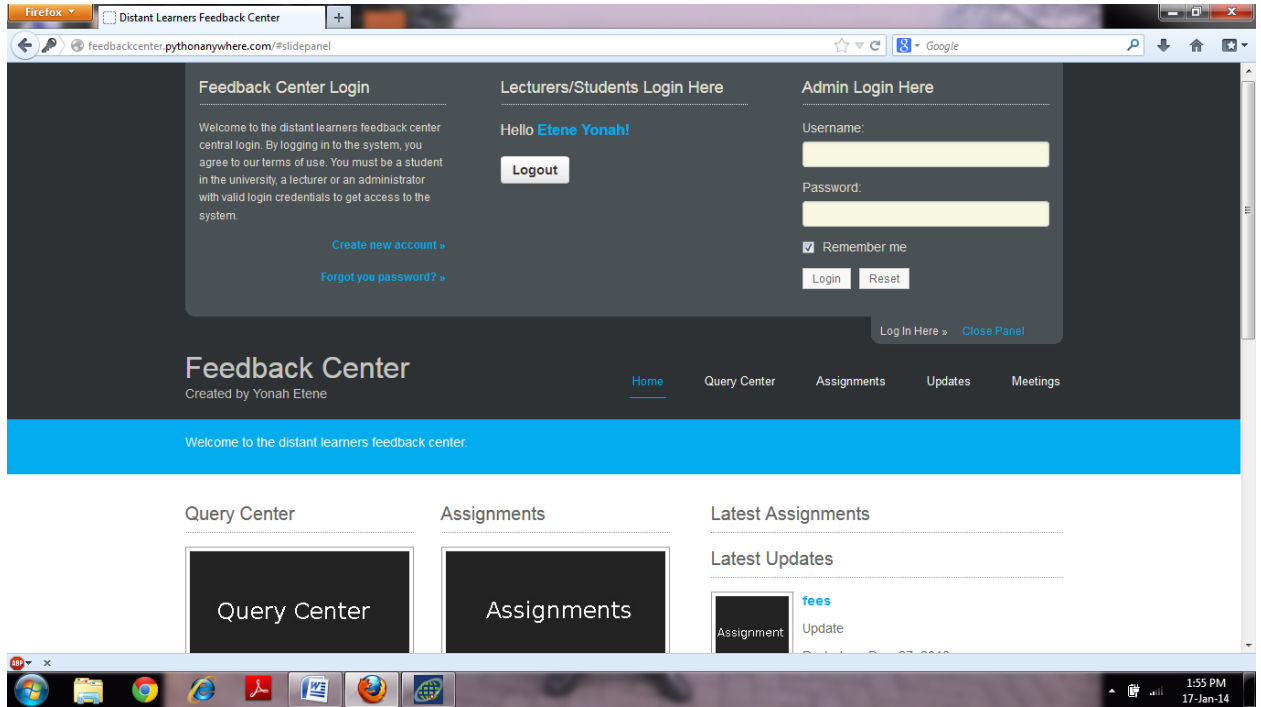
Feedback alert to learner on question asked



Fees updates received



Log out Screen



APPENDIX III

Sample code

```
fromdjango.db import models

fromdjango.contrib.auth.models import User

fromdjango.utils.translation import ugettext as _

fromuserena.models import UserenaBaseProfile

class Assignment(models.Model):

    title = models.CharField('Title', max_length=100)

    unit = models.CharField(max_length=30)

    created_on = models.DateField(auto_now_add=True)

    created_by = models.IntegerField()

    date_due = models.DateField()

    def __unicode__(self):

        return self.name

class AssignmentQuestion(models.Model):

    content = models.TextField(max_length=255, verbose_name="Question")

    list = models.ForeignKey(TodoList)

    def __unicode__(self):

        return self.name + " (" + str(self.list) + ")"

class UploadedAssignment(models.Model):

    document = models.FileField(upload_to='documents/')

    assignment = models.ForeignKey(TodoList)

class AttemptedAssignment(models.Model):

    assignment = models.ForeignKey(TodoList)

    answer = models.TextField()
```

```

attempted = models.IntegerField(max_length=1,default=0)
submitted = models.IntegerField(max_length=1,default=0)
submitted_on = models.DateField()
score = models.IntegerField(max_length=3, help_text='Score')
posted_by = models.IntegerField(max_length=10)
posted_by_name = models.CharField(max_length=50)
class Meeting(models.Model):
    title = models.CharField('Meeting Title',max_length=150)
    venue = models.CharField(max_length = 50)
    date = models.DateField()
    theme = models.CharField(max_length=150)
    description = models.TextField()
    posted_by = models.IntegerField()
    posted_on = models.DateField()
class Question(models.Model):
    ACADEMIC_CHOICES = (('Y','Academic Question'),('N','Non-Academic Question'))
    posted_by = models.IntegerField()
    posted_on = models.DateField()
    academic = models.CharField(verbose_name='Question Type',max_length=1,
    choices=ACADEMIC_CHOICES)
    title = models.CharField(max_length=150)
    content = models.TextField()
    category = models.CharField(max_length=30)
    posted_by_name = models.CharField(max_length=50)
class Answer(models.Model):

```

```
ANSWER_CHOICES = (('Y','Yes, this answer was satisfactory'),('N','No, this answer was not satisfactory'))
```

```
question_id = models.IntegerField()
```

```
posted_by = models.IntegerField()
```

```
posted_on = models.DateField()
```

```
helpful = models.CharField(max_length=1, choices=ANSWER_CHOICES)
```

```
content = models.TextField(verbose_name=u'Answer:')
```

```
posted_by_name = models.CharField(max_length=50)
```

```
class Update(models.Model):
```

```
    UPDATE_CHOICES = (('fees','Fee update'),('lecturer','Change of lecturer'),('unit','Change of unit'),('other','Other update'))
```

```
    update_type = models.CharField(max_length=15, choices=UPDATE_CHOICES)
```

```
    posted_by = models.IntegerField()
```

```
    posted_on = models.DateField()
```

```
    content = models.TextField()
```

```
class MyProfile(UserenaBaseProfile):
```

```
    user = models.OneToOneField(User, unique=True, verbose_name=_('user'), related_name='my_user_profile')
```

```
    phone_number = models.CharField(max_length=10)
```

```
    designation = models.CharField(max_length=20)
```

```
    course = models.CharField(max_length=50)
```

```
    specialization = models.CharField(max_length=50)
```

```
    response_type = models.CharField(max_length=20)
```

```
    year_of_study = models.CharField(max_length=20)
```

```
class RequestCall(models.Model):
```

```
    posted_on = models.DateField()
```

```
posted_by = models.IntegerField()
```

```
content = models.TextField(verbose_name=u'Request text:')
```