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Integrated students, coordinators and companies system for students' field attachment coordination for Tanzanian higher learning institutions

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INTEGRATED STUDENTS, COORDINATORS AND COMPANIES SYSTEM FOR STUDENTS' FIELD ATTACHMENT COORDINATION FOR TANZANIAN HIGHER LEARNING INSTITUTIONS

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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master's in Information and Communication Science and Engineering of The Nelson Mandela African Institution of Science and Technology

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ABSTRACT

Work-based learning is what equips students with practical skills. All higher learning institutions (HLIs) have a specified period of time for students to carry out field based practices in companies which are relevant to their fields of study. As the number of students in Tanzanian HLIs become larger, coordination and allocation of students to relevant companies is becoming tougher. This study therefore intended to examine a better method to facilitate coordination and allocation of students to relevant companies through development of an online system. The research study to determine systems' requirements was conducted in Arusha and Kilimanjaro by involving 62 HLI students, 3 HLIs and 5 companies. Data were collected using key informant interviews, observation and workshop. Both informative and descriptive information regarding current practices and desired features were collected and analyzed. The results show that, a platform need to have main features of Students' profiles, companies' information, application feedback, supervision reports, and assessment of students by companies and their respective HLIs to address the challenge. The features determined gave efficiency advantages to all three main stakeholders who are HLIs, students and companies.

Prior to actual system implementation, collaborative prototype was designed using pencil software and shared to 5 users from each group to evaluate the tasks based on provided scenarios. To refine the requirements, responses from users were accommodated and the final prototype design was used to develop Field Attachment Management System (FAMS). The system was finally validated and tested for usability and indicated to have improved access by students to relevant companies, reports generation, students' assessment and follow-up conducted by HLIs to their students.

DECLARATION

I, **Erick R. Samwi**, declare that this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for consideration of a similar degree award at any other University.

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CERTIFICATION

The undersigned certify that they have read and found the dissertation conform to the standard and format acceptable by the Nelson Mandela African Institution of Science and Technology.

Dr.Kisangiri Michael		23.03.2020
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DEDICATION

This study is heartily dedicated to my parents, the reason for what I become today. You taught me to believe in hard-working, be honest and humble in every situation. Thank you!

To my brothers, sisters and friends who continually provide their encouragements, inspirations and care.

And lastly but not least, to God, thank you for health life, protection, skills and power of mind.

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LIST OF ABBREVIATIONS

ACRONIMY	DEFINATION
HLI	Higher Learning Institution
TCU	Tanzania Commission for Universities
OPUS	Online Placement University System
ITAP	Industrial Training Attachment Portal
DAAD	German Academic Exchange Service
JAD	Joint Application Design
UI	User Interface
GUI	Graphical User Interface
WAMP	Windows, Apache, MySQL and PHP
PHP	Hypertext Pre-processor
CSS	Cascading Style Sheet
HTML	Hypertext Markup Language
IDE	Integrated Development Environment
DHBW	Baden-Wuerttemberg Cooperative State University
SDLC	Software Development Life Circle
TERNET	Tanzania Education and Research Network
US	User Story
REQ	Requirement
ERD	Entity Relationship Diagram

CASE	Computer Aided System Engineering
CSV	Comma-separated Values
DBMS	Database Management System
SQL	Structured Query Language
XML	Extensible Markup Language
CMS	Content Management System
UX	User eXperince

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Field attachment is placement of students in companies or organizations for practical training, aiming at preparing them for tasks related to their field after they complete their studies (Abdullah *et al.*, 2017). Different Higher Learning Institutions (HLIs) refer field attachment using different names including: practical projects, practical training, field work, field practices and internship. In this context, field attachment is used to refer field-based practices carried out by HLI students in companies but with close follow-up of their respective HLIs. For all HLIs, field attachment is a mandatory as is one of the graduation requirements for students. Time for students to be in companies for their field attachment is one to four months depending on guidelines of their respective HLIs.

Most of complaints among HLI students are due to lack of adequate learning opportunities during field attachment (Baird, 2016). This is because, getting relevant companies for HLI students and coordination of field attachment remain a key challenge. The problem becomes worse with gradual increase of HLI students in Tanzania, where according to Tanzania Commission for Universities (TCU) enrolment in HLIs increased from 123434 to 218959 as from 2009/2010 to 2013/2014 academic years (TCU, 2019). It is reported that, higher learning institutions in developing countries face difficult in finding proper onsite career development due to lack of access to relevant companies (Chand & Deshmukh, 2019).

There is a growing body of literatures that recognizes the need for the methods that enable students to get relevant companies and HLIs to coordinate the field attachment. Different HLI in Tanzania have solutions ranging from excel sheet forms to custom computer system for making coordination easier, quicker and more efficient. The question then arises: are the methods enough to address the coordination and allocation challenges?

Far too little attention has been paid to linking and providing information of relevant companies to students. Currently, students manage their documents and search for companies manually. Manual searching has shown to be unreliable and expensive in terms of time and resources.

1.2 Statement of the Research Problem

Different higher learning institutions use various platforms to facilitate the management of field attachments. These range from excel sheet forms to custom computer systems to assist in management and coordination of field practices. However, far too little attention has been paid to linking and providing information to students about companies where they can do their field practices.

Currently, with existing systems for managing field attachments in higher learning institutions, students manage their documents and search for companies manually. They submit applications to companies through email, post or by hand delivery and wait for delivery. The coordinator is notified by students on acceptance or rejection for further supervision proceedings. The process seems to be expensive in terms of time and resources for coordinators, students and companies. The existing process model for field attachment coordination is as indicated in Fig. 1.

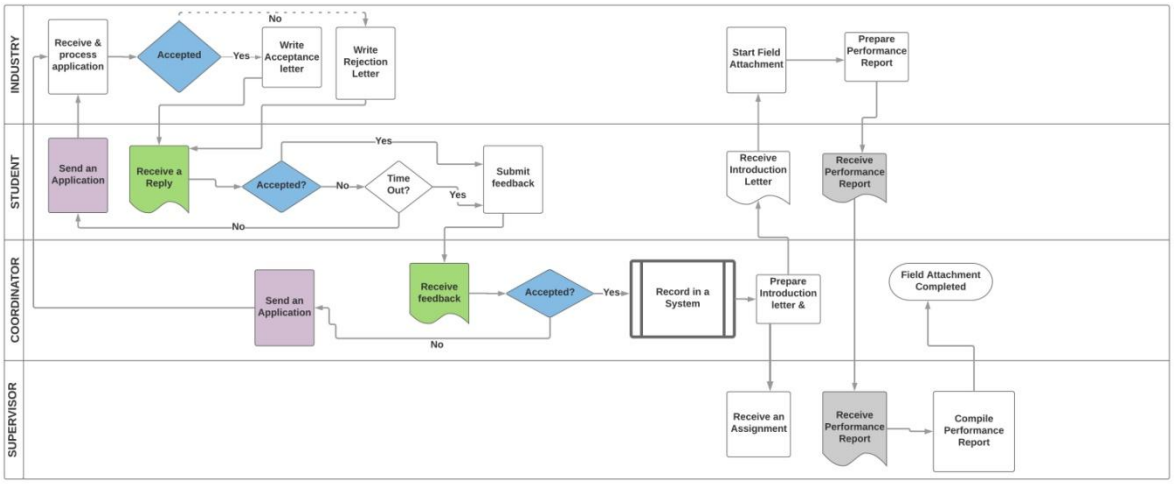


Figure 1: Current Field Attachment Process Model

The focus of this research study was to find the common solution by integrating key features of all three stakeholders regarding students' field attachment.

1.3 Rationale

Modern technology has come with the advantage of Content Management Systems (CMS) which is a breakthrough towards achieving the interface for coordination of field attachments (ChanLin & Hung, 2015). Web-based system was developed to allow companies to be registered and post requirements for field attachment and higher learning institutions to have

accounts and being able to manage the process through the system. The developed system is a stepping-stone for further upgrades and thus it paves a way for more features like analysis of feedbacks from companies for regular curriculum reviews. Furthermore, the system solves current challenges to a greater extent; cost and time consumed to facilitate field attachment can also be reduced.

1.4 Objectives

1.4.1 General Objective

The general objective of this study was to develop a web-based system to integrate companies and higher learning institutions for effective management and coordination of field practices.

1.4.2 Specific Objectives

The specific objectives of this study were:

(i) To identify the user and system requirements

(ii) To design and implement the system

(iii)To validate the system for usability.

1.5 Research Questions

The research questions that this dissertation intended to answer were:

(i) What are the requirements for developing a field attachment coordination system?

(ii) How will the system facilitate the process?

(iii)What are the opportunities and challenges of a field attachment coordination system?

1.6 Significance of the Study

This study provides new insights into linking and open collaboration between companies and higher learning institutions. It further explains the user-centred approach towards designing and implementing a system for effective management and coordination of field attachment. Therefore, the findings should make an important contribution to the field of UX in Tanzania.

1.7 Delineation of the Study

The study conducted did not include HLIs which are responsible for finding posts and allocate student based on their allocation policies. It was also not possible to study all related systems due to lack of either existing literature about them or login access to them. Systems reviewed in this study are those which have literature as well as those with access credentials provided.

CHAPTER TWO

LITERATURE REVIEW

2.1 Related Works

The literature on related studies highlighted several approaches that can be used to facilitate the field attachment allocation and coordination process. Research such as that conducted by Abdullah *et al.* (2017) suggested a system that registers organizations and allow searching and recommendation of best organizations to internship applicants. This system has advantage of helping students to identify companies which are relevant to their study areas. However, the coordination as well as follow-up parts remain to be manual and challenging. Moreover, Tripathi, Singh and Jaweria (2018) suggested a system with companies having ability to view students' resumes and make selection decision. This was complemented by another research by Nilesh, Pooja and Sunita (2016) who proposed a system through which companies can gain information about eligibility and interests of students before going for recruitment. The two approaches help to link students to potential companies but they do not consider students' choices and coordination by their respective HLIs. Not only that but also, Michael (2016) proposed a system that automatically recommends suitable organizations to students using area of study and location preferences. Regardless of the fact that the system facilitates access of relevant companies' to students, it does not solve the challenges associated with prolonged processes when it comes to follow-up and coordination done by respective HLIs. Another proposed approach is that of a system where organizations provide application links for students to be able to apply (Michael, 2016). With this approach, students could easily send their applications but does not guarantee other coordinating features like follow-up and reporting. Furthermore, Gopalswamy and Valarmathi (2016) proposed a system for notifying students about the placement through Bulk SMS and Email. The proposed system cannot facilitate the coordination and it is most likely for students to have received information of companies which are not relevant to their field of studies.

To facilitate their dual model where academic studies are integrated with workplace training, Baden-Wuerttemberg Cooperative State University (DHBW – Heidenheim) introduced an online portal. Through that portal students sell their capabilities and interests to potential companies. The portal helped to open collaboration between the university and companies.

The major limitation is that, by being a university specific portal, one company has to be linked to multiple portals to be able to receive profiles of students from different HLIs.

In Tanzania, several attempts have been made to facilitate coordination process. For example, College of Information and Communication Technology (CoICT) at University of Dar es Salaam developed a web-based system for allocating, assessing and receiving reports from students during field attachment (PTMS, 2018). As this system can only facilitate the coordination part, it cannot be regarded as a solution to the current challenges of getting relevant companies. Moreover, the major challenges facing students and companies side are not addressed with this specific system.

The existing systems were developed in two different approaches. The first approach is those with students, coordinators and lecturers as users. The coordinators have to find the industrial placements and feed the data into systems and allow students to apply. After allocation, industries receive the list from the coordinator via other means of communication (Student Industrial Linkage Management System, 2018). The second approach includes host companies as users who have interface to interact with the system. Companies have accounts to fill in information about qualifications and number of students they can host (Industrial Training System of UTM, 2018). All these approaches involve systems which are university specific, which is a challenge for companies' side as they have to link with multiple platforms in different universities.

Overall, these studies highlighted the need for a computerized system to facilitate the management and coordination of field attachment. Debate continues about the best strategies for addressing the challenge. This is because, the suggested approaches, have failed to address the challenges of linking both higher learning institutions, students and organizations which offer field practical trainings. Furthermore, such studies indicate that, effective solution needs to have features that will give advantage by integrating features of all three main stakeholders who are HLIs, students and companies. The features of the existing related systems are as indicated in Table 1.

Table 1: Summary of Features in Reviewed Related Works

System	Features								
	Students' profiles upload	**Companies information & adverts**	**Apply for company**	**Application feedback**	**Lecturers supervision**	**Supervision reports**	**Coordination reports**	**Assessment by University**	**Assessment by Company**
Company Recruitment and Placement System		√	√						
SIWES Recommendation System		√							
Online Placement University System (OPUS)		√	√	√	√			√	√
Industrial Training Attachment Portal (ITAP)	√	√	√	√					√
DHBW-Heidenheim Portal	√	√	√			√		√	√
Practical Training Management System (PTMS)					√	√	√	√	
PROPOSED PORTAL	√	√	√	√	√	√	√	√	√

2.2 Development Approaches

Research conducted by Shayo, Mwase and Kissaka (2017), reported the failure to adopt a system developed for university of Dar es Salaam regardless of the need of the computerized system for management and coordination of practical trainings. Users' awareness was revealed to be one of the reasons for the failure. This implies that, users were not involved and therefore the developed product had poor User Experience (UX). The life of software much depends on UX and therefore it a vital part to consider during software development (Harutyunyan & Riehle, 2019). It is revealed that regardless of the benefits of the system, users tend to reject systems with poor UX (Sikorski, 2008). According to research done, users do not tolerate and only 16% will be willing to try applications with poor UX more than twice (Convertino & Frishberg, 2017).

User experience of a system is influenced by the techniques used to develop it. The study done by Sy (2007) to compare the usability of Agile and waterfall model designed software show that, Agile which is a collaborative user-centred design resulted in software with better usability. The main disadvantages of waterfall model are irreversible development phases and testing is done when software is complete and thus makes no room for users' complete involvement and flexibility to changes (Sommerville, 2011). The methodological approach used in this study is a mixed approach based on scrum. Scrum is a framework which involves use of various processes and techniques to come up with product of the optimum value (Schwaber & Sutherland, 2017). Scrum framework ensures the involvement of users in testing starting from the early development stages to continuously improve the product (Kieffer, Ghouti & Macq, 2017). Moreover, involvement of users in all stages of development not only exposes design issues at the early stages of development but also positively affects the usability of a system (Myers & Stylos, 2016).

2.3 Validation Methods

Although several methods exist to conduct usability evaluation, the suitability of a method depends on a scenario and type of software product (Paz & Pow-sang, 2016). To allow major coverage of usability aspects, multiple methods were employed in this study. Quantitative usability metrics regarding effectiveness, efficiency, and satisfaction were established by applying user testing and questionnaires (Ashraf, Shabbir, Saba & Mateen, 2017). User testing was preferred in this study because is the most useful usability evaluation method for the website since selected users execute some tasks while their performance and satisfaction are recorded (Mvungi & Tossy, 2015).

CHAPTER THREE

MATERIALS AND METHODS

The methodological approach used in this study is a mixed approach based on scrum. Scrum is a framework which involves use of various processes and techniques to come up with product of the optimum value (Schwaber & Sutherland, 2017). The main advantage of scrum is that, predicting and controlling the risks which may cause rejection of the final product is optimum (Schwaber & Sutherland, 2017). The combination of techniques was used in requirements elicitation, design, implementation and validation to optimize the chance of coming up with the best results.

3.1 Study Area

This study was conducted at Arusha and Kilimanjaro regions which are located in the northern part of Tanzania. There are 10 universities and institutions which offer different fields of higher-level studies located in the two regions. Moreover, there are tourism, Information Technology and agricultural companies as well as government and non-governmental agencies which offer field attachment for students. The selected study area has a good number of target stakeholders with a perfect mix of variations of requirements based on fields of studies and companies core activities.

3.2 Requirements Elicitation

Several methods currently exist for determining the system requirements. There are traditional methods including interviewing, questionnaires, documents analysis and observation, as well as modern methods such as Joint Application Design (JAD) and prototyping. The methods for requirements determination have different characteristics in terms of richness of information, the time required, expenses, follow-up odds, level of user involvement of subject and number of potential audience (Groves *et al.*, 2009).

Accuracy and completeness of requirements information have been confirmed to be reasons for systems to succeed (Pitts & Browne, 2004). This study employed a mixed-methods approach to ensure high level of user involvement of subject and information richness. Requirements elicitation techniques that were used are key informant interviews, observations and requirements workshop.

3.2.1 Key Informant Interviews

Key informant interviews involve dialogue with people who are well informed in that particular subject to capture their ideas and insights (Kumar, 1989). It is the method that is suitable for getting qualitative and descriptive information as it allows free flow of ideas and information from respondents (Pact, 2014). By employing a key informant interview, gives advantage of gaining relevant insights, big picture of a situation as well as room for new ideas (Kumar, 1989).

Key informant interviews were conducted with 62 students, 3 coordinators and 5 companies' representatives. Criteria for selecting students were based on inclusion composition of students who once attended field practices, students who were applying for the first time and those who have never either applied or attended field practices yet. For the side of coordinators and companies, a number of respondents were relative to their availability in a research area.

Most of the interview questions were open-ended to allow informative answers from users. In order to identify the magnitude of the challenges, the participants were asked to give a picture of what would happen if no changes will be done to the current process. Moreover, participants were asked of what they will regard as a success after the introduction of the system that will facilitate the process. The proposed features from respondents were analyzed and accommodated in the general prototype of the new system. For coordinators and companies, it was not possible to perform quantitative analysis due to small size of dataset, thus only qualitative analysis was done. In analyzing quantitative data, descriptive statistics were used by applying Ms Excel and SPSS. Qualitative data were analyzed through content analysis and information was then integrated with quantitative information to provide more meaningful analysis.

3.2.2 Observations

Observation is a method that enables an analysis of the current process by either watching or participating in using the product (Drury, 1995). Observation method helps not only to understand how users operate but also provides inspiration and idea for advancement and innovation opportunities (Kawulich, 2005). The main advantage with observation method is that accurate information regarding the current situation is guaranteed and gives direct

feedback on how improvement can be made. Unlike other methods, observation with complete participation does not depend on respondents' willingness to respond (Yilmaz, 2013).

In this study, observation conducted was complete participation by playing the role of a coordinator which in turn, full nature of coordination process was reflected. During observation, forms and other tools that are used to coordinate were studied. Finally, ideas for improvement opportunities were noted for being accommodated as features for new system.

3.2.3 Requirements Workshop

A requirements workshop is a facilitated event that brings together stakeholders for the aim of discussing and refining requirements (Gottesdiener, 2002). Through requirements workshop, the majority of the requirements can be obtained within a short period while gaining stakeholders consensus.

Requirements workshop composed of 8 students was conducted for the aim of brainstorming the challenges that they are facing. A user story is defined as a statement which describes functionality that is of value to a user of a system (Cohn, 2004). There are some variations in presentation of user stories but all have the same three basic components. According to Lucassen, Dalpiaz, van der Werf and Brinkkemper (2016), the basic components of user stories are; description of the one who is representing the user story, what is expected from the system and the criteria to accept a specific requirement. The three basic components are helpful in knowing the requirements based on type of user as well as why a specified requirement is important. Through the workshop, user stories were identified and formulated considering those three components with exception of few stories which seem to have important requirement but user fail to give acceptance criteria. A number of system requirements were identified and finally included in the product backlog.

To make each participant feel comfortable and contribute in the session, the workshop guide was prepared and the aim of the workshop was well introduced. All stories were recorded on paper following the format as indicated in Fig.2. User stories helped to describe the features needed by users but not how to implement the features. To enable users to contribute to how they would want the features to be implemented, wireframes were prepared and prototyped for users' interaction.

As a <*type of user*>	User Story ID	I want to <*perform some tasks*>	so that I can <*achieve some goals*>

Figure 2: User Stories Template

3.3 System Design

The solution design process involved the creation of a prototype. The prototype is an interactive sample of the system explaining the actual functionality of the final product that users can feel and use by navigating from page to page (Houde & Hill, 2007). Since prototypes allow users to see how the final product will be, concepts can be approved and more importantly usability flaws can be uncovered early in the project lifecycle. Prototyping improves collaboration with users and thus allow earlier usability testing and feedbacks which in turn save the costs of late changes (Houde & Hill, 2007).

3.3.1 Interface Design

The collaborative prototype design is an innovative user-centred approach to system design that enables designers to involve more users in testing the tasks (Andrews *et al.*, 2012). Based on features suggested by users during interviews, observation and requirements workshop, web pages were sketched on paper. The pencil software was then used to translate the sketches into wireframe. Pencil software is a free and open-source prototyping tool that allows design of web pages and save them as clickable wireframe pages. The wireframe pages were finally used to create a prototype by linking pages and saving them as clickable web pages. The prototype was sent to 5 users of each group via email addresses. Task scenarios (attached in Appendix 2) were given to users and asked to complete and give their opinions. Users responded by pointing out missing features, difficulty they faced and suggestions. The process involved destroying previous prototypes to accommodate new inputs and suggestions from users. Figure 3 is a sample of paper sketch of a first design.

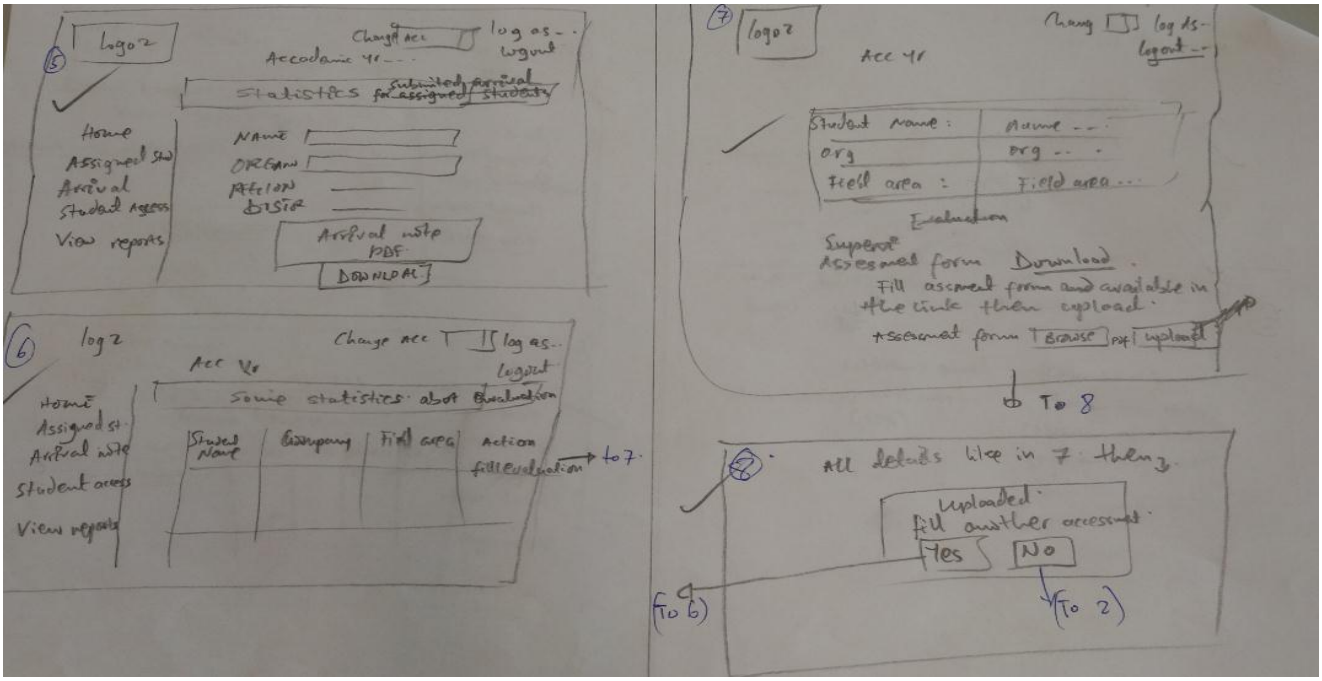


Figure 3: A Paper Sketch of an Interface Design

3.3.2 Database Design

To accommodate all data required for a system to function, a database was designed and relationships between tables of data were determined prior to database implementation. The database was designed using MySQL Workbench. MySQL Workbench is a powerful data model development tool which captures only One-to-One and One-to-Many type of relationships between database tables (Letkowski, 2014). With MySQL Workbench, Many-to-Many relationships are automatically converted into set of two One-to-Many relationships.

3.3.3 Architectural Design

Not only a prototype but also an architectural design is a key approach to build the right product that accommodates all desired properties (Devadiga, 2017). Having information of all desired features and properties before the development of a system, led to both increased success rate and easy monitoring of the system development progress. In a process of coming out with a design which has information about all important features and properties of a system, an architectural design of layers was produced. FAMS architecture gave an overview of layers in which the system must be configured to accommodate the process model that allows flow of information among all stakeholders using both smart phones and computers.

3.4 System Development

Agile software development using scrum framework involves various processes and techniques to continuously improve the product. Scrum is an effective framework especially in iterative and incremental software development since it ensures delivering products of the highest possible value by addressing complex adaptive problems through frequent inspection of progress to detect undesirable variances. Moreover, predicting and controlling the risks which may cause rejection of the final product is optimum in using Scrum, this is due to the fact that it employs an iterative, incremental approach (Karabulut & Ergun, 2018).

3.4.1 Approach

The development of a system was done in increments. List of functional requirements from product backlog analyzed during requirements elicitation were given priorities based on their dependencies. Sprints are defined period series to release an increment of the product with a target of meeting and exceeding customer expectations through testing and progress inspections (Karabulut & Ergun, 2018). The tasks were then categorized into sprints which were defined as time-boxes of two weeks to release an increment of the product. For each sprint, criteria for acceptance were defined by thoroughly investigating functional features of each task. For a task to be regarded as completed, the description that defines a specific task to be done was also set. The part of final product backlog including acceptance criteria and definition of tasks to be regarded as done tasks is as indicated in Fig. 4.

Product Backlog

Story ID	Tittle	User story	Priority	Sprint	Acceptance Criteria	Defination of Done	Status
1	Viewing posts advertisement	As a student I want to be able to get information of available organizations in the system and apply through the system	1	1	1. Being able to view available organizations 2. Being able to select an organization and send application to	1. Passes validation tests 2. Passess testing per acceptance criteria items 3. Able to show features in demo	Planned
2	Selection Feedback	As a student I want to be able to signup and registered in the system so that I can do follow up for the feedback	2	2	1. Accept new students login details and save 2. Generate success or failure message after processing 3. Student must be able to view selection status		Planned
3	Selection of post to apply	As a student I want to be able to see all available organizations so that I can choose one to apply	1	1	1. Display all available organizations 2. Able to choose one and apply		Planned
4	Reporting	As a student I want to be able to share my weekly reports to supervisor so that he/she can comment on my progress	5	5	1.Student should be able to fill daily report 2. Supervisor should be able to send a comment on the report		Planned

Figure 4: Part of the Product Backlog

The first sprint involved tasks which best understood in the first place. This helped to have a base of an intended product while continually gain understanding of the other ordered list of requirements that were needed in the product. For each sprint, a tracking sheet was prepared

so as to monitor and evaluate the progress of an increment development. The tracking sheet was composed of a burn down chart which measures daily actual progress versus the ideal distribution of tasks in two weeks time as indicated in Fig. 5. The estimated remaining time to complete a specific task in a sprint was recorded and used to monitor the progress. After completion of each sprint, a unit test was done based on definition of done and acceptance criteria of each task.

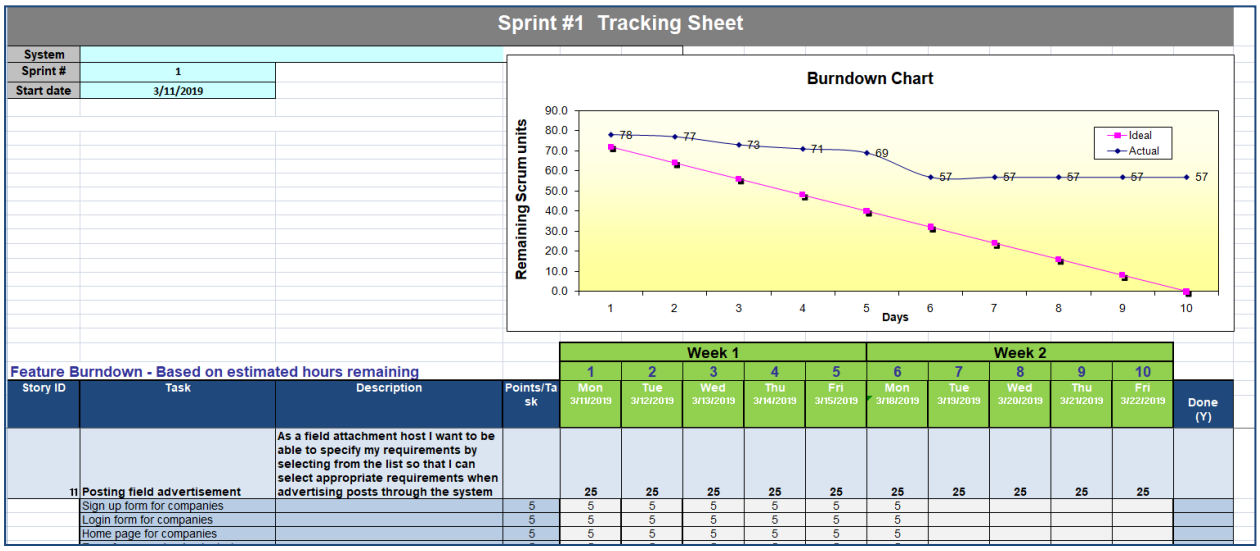


Figure 5: Sprint (Increment) Tracking Sheet

Figure 6 is a framework of a Scrum development approach that was employed to develop a field attachment system.

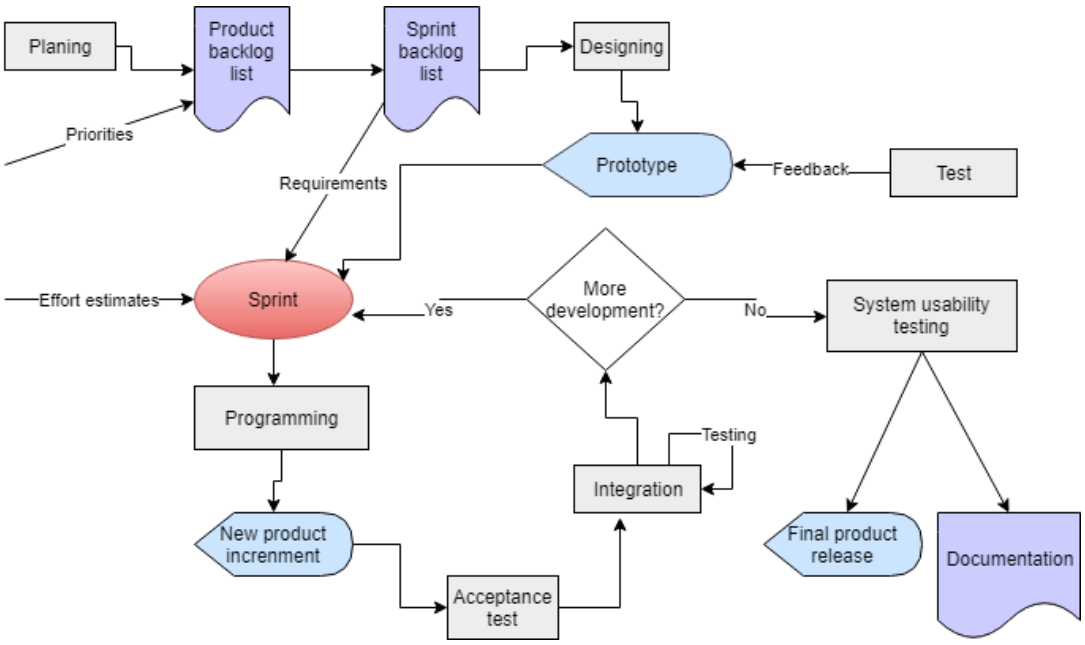


Figure 6: Scrum Development Approach

3.4.2 Tools

WAMP server was used to develop the system. WAMP is a package of independently-created programs compatible with Microsoft windows operating system. It is composed of a web server called Apache, MySql as a database management system and PHP as a server-side scripting language. Java scripts were also used for rollover effects, roll out effects and graphics. Furthermore, the Integrated Development Environment (IDE) that was used as a code editor is NetBeans since it supports latest versions of programming languages including PHP 7.2.14 and has much functionality compared to counterparts like notepad++, notepad and eclipse.

System's interfaces were implemented by using HTML and CSS in separate files. HTML was used to describe the structure and contents of web pages while CSS was used to describe the web pages styles including layout, colours, and fonts. Maintenance of pages, sharing of style sheets across pages and tailoring of pages to different environments were made easy due to separation of HTML and CSS files. Responsive design is application of CSS to create web pages with dynamic layouts depending on size and structure of devices used to view them (Baturay & Birtane, 2013). All FAMS features were accommodated within the main system layout and formatted to meet responsive design needs. The responsive design allowed

interface design and development to respond based on screen size, platform and orientation of the device used to open the system.

3.5 System Validation

Software Validation refers to the evaluation of software product, with the aim of ensuring that the software meets specified requirements and users' demands and expectations (Hailpern & Santhanam, 2002). Validation is also used to confirm that the functional requirements are consistently fulfilled. Apart from validation, usability testing was employed to test the design and the developed system. Usability testing is the type of software testing where real users evaluate a system by being given a number of task scenarios to complete. The main focus of usability testing is on how easy is to use the system, flexibility in recovering from errors and the ability of the system to meet its objectives. Since usability testing is performed starting from earlier stages of system development, it gives wide chance of meeting users' expectations and reduces the risk of coming out with the wrong final product (Corry, Frick & Hansen, 1997).

3.5.1 Validation

After implementation, FAMS was validated to confirm the consistency of the functional requirements and whether it is acceptable for use. A plan composed of definition of testing data was prepared to guide the validation process. Defined testing data was used to test the strength of the developed system and the results were noted. Having a plan to guide the system validation helped to test every user requirement and confirm whether the system was built right. The validation test plan that was used is as indicated in Table 2.

Table 2: Validation Test Guide

S/N	Requirement	Validation Test Data
1.	User registration	Invalid registration information Valid registration information
2.	Login testing	Invalid Username and Password Valid Username and Password
3.	Uploading students list into the system	With empty fields Repeating registration number Correct entries and submit
4.	Adding Supervisors into the system	With an empty field Repeating Supervisors name Correct entries and submit
5.	Advertise field attachment post	With missing field entries Correct entries and submit
6.	Apply a field attachment post.	With missing information Correct entries and submit
7.	Allocating Supervisors.	With an empty field Correct entries and submit
8.	Submit reports	With the wrong format Following defined format
9.	Search for a company	Specify location Specify location and category Specify location, category and company

3.5.2 Usability Evaluation

Usability evaluation is the process of ensuring that a system meets usability criteria by involving real users in its evaluation (Corry *et al.*, 1997). The evaluation of a system can be done by giving real users number of task scenarios to complete and collect feedbacks. Usability test plan composed of task scenarios for each group of users was prepared to guide the usability testing sessions. Selected users were introduced on the aim of the test session and then required to complete task scenarios. The main usability information that were recorded are time taken by a user to complete a task, users' satisfaction and whether user can complete the goal, do a task correctly, get a needed help and perform the task correctly the first time. Together with the usability metrics that were recorded, users who were involved in testing responded on the following questionnaires:

(i) Pre-test Questionnaire

The purpose of this questionnaire was to understand the type of user who is doing a test. Questions in this section were used to interpret whether the results of test are in one way or another depend on character of a user involved in testing. Users' information captured using pre-test questionnaire were on type of devices they use to open websites, frequency of using computers, sites they normally visit and experience on using online portals.

(ii) Post-task Questionnaire

Post task questionnaire was prepared to get opinions of users on each task. Users involved in the testing were able to respond and give their experience on how did they find the process of completing a specific task using a developed system. They were further allowed to suggest some improvements.

(iii) Post-test Questionnaire

At the end of the testing session, users were also given a post-test questionnaire. The aim of post test questionnaire was to get the usability metrics of the entire system. All the responses were recorded in the form of ratings where respondents were allowed to rate different usability features from strongly agree (+2) to strongly disagree (-2).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 System Requirements

The first objective of this study was to identify the user and system requirements. This section discusses the results of analysis of user requirements and further explains both functional and non-functional requirements of the system (FAMS). The first set of analyses examined the current practices and their challenges. Furthermore, what users would regard as a success as well as the key features was analyzed. The results of analysis are presented in the following subsections:

4.1.1 Current Field Attachment Application Methods

In the study area, all respondents reported that there is no system to facilitate field attachment coordination. Figure 7 shows the results obtained from the analysis of methods that students use to apply for field attachment. A percentage amounting to 62.9 of responded students reported that they send application letters to different companies via post offices. The other methods which were reported by students are email and physical delivery of applications. With reported application methods, coordinators are responsible for giving students introduction letters to send with applications to different companies.

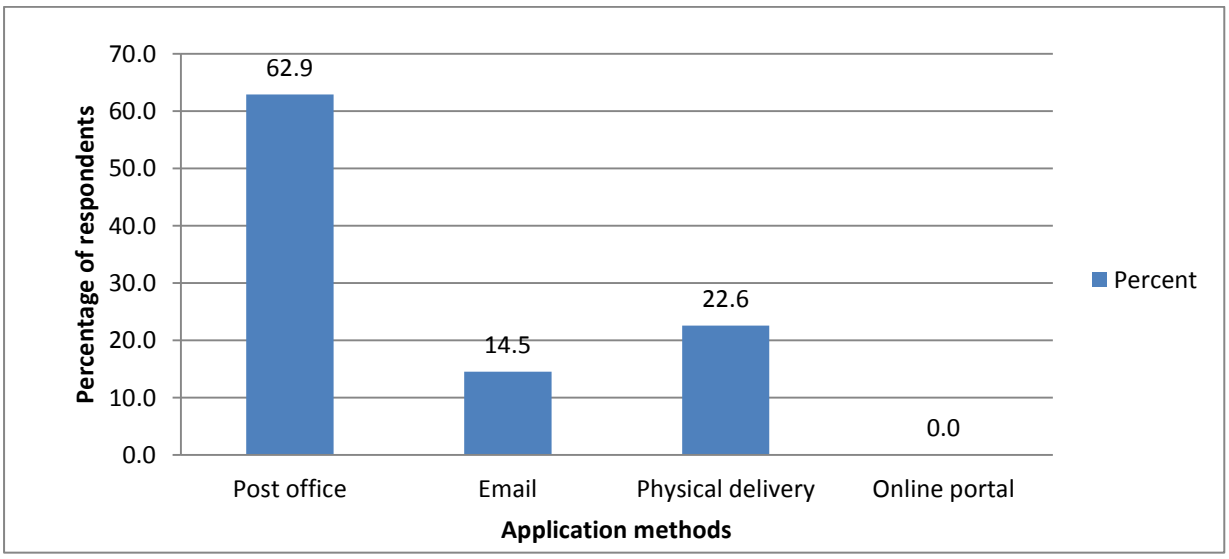


Figure 7: Description of Current Field Attachment Application Methods

4.1.2 Elicitation of Companies' Information

From data in Fig.8, half of the students who responded reported that they get information about the companies where they can apply from their friends. On the other side, 46.8% reported that they just send applications to companies without having reliable information about companies. Only 3.2% of respondents do search for company information from the internet and no respondent reported to have seen any company advertising available field practices posts. Respondents were further asked as to why they do not search for companies' information over the internet. The response was that only few companies can be found and no information that they want as application guidance is provided over the internet. Coordinators were also asked if they assist students to get companies information. One of coordinators responded that they sometimes send lecturers to travel to different regions in search and book for companies for their students.

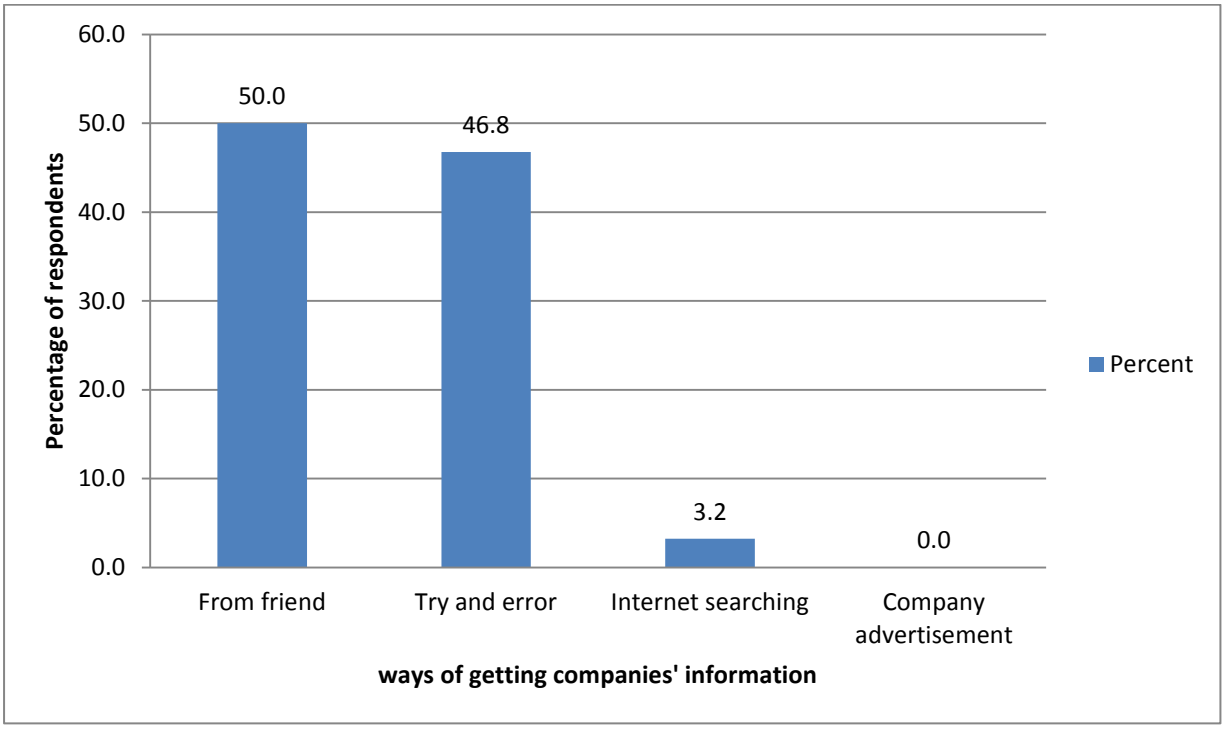


Figure 8: Methods of Getting Companies' Information

4.1.3 Challenges with the Current System

As shown in Table 3, the current practice has several challenges to the side of students. Most of respondents reported that the feedback from companies after they send applications is either delayed or not given at all. In turn, lack of feedback causes students to end up going to other places which are not in coordinators' information. The feedback challenge was reported

by 83.9% of respondents. Other most reported challenges were the cost in term of time spent to get a company and lack of companies' information in terms of availability of posts, location and chances to learn.

A number of challenges facing the coordination side were also identified by coordinators. One of the challenges reported was getting correct students' allocation and field reports. This is because students go to places not known by coordinators and they do not have a way to update their information. Moreover, field assessment reports are collected from companies and submitted to the coordinators by students themselves. Other challenges reported by coordinators include; time-consuming, lack of collaboration with companies and hardship to find companies for students. Furthermore, one company reported that it is time and resources consuming to process and give feedback to many applications that they manually receive.

Table 3: Challenges with the Current Process

Challenge	Responses		Percentage of Cases
	N	Percentage	
Delay of feedback	46	35.4%	74.2%
No feedback	6	4.6%	9.7%
Time consuming	40	30.8%	64.5%
Lack of field attachment information	32	24.6%	51.6%
Lack of communication with supervisor	6	4.6%	9.7%
Total	130	100.0%	209.7%

When the respondents were asked about their concern with the current challenges, the majority commented that with time, the coordination becomes tougher, getting places become more difficult and efficiency of learning is deteriorating. The challenges increase as a result of gradual increase in number of students in higher learning institutions.

4.1.4 Success Factors

Table 4 shows responses of students as to what will they regard as a success if the current practice is changed. Being able to get information about companies and apply through the system where they can easily follow-up for feedback, are what mostly reported by students who responded. Coordinators were also asked about what will be a success in their role and the responses show that the system that will enable them to get all the reports as well as facilitate the allocation exercise is what they will regard as success. They further showed

their concern about finding companies for students and thus reported that students to get information about companies will be a success.

Table 4: Success Factors

Success factors	Responses		Percentage of Cases
	N	Percentage	
Getting acceptance and rejection feedback	46	37.7%	74.2%
Be able to apply through the system	48	39.3%	77.4%
Knowing details of services offered by organizations	28	23.0%	45.2%
Total	122	100.0%	196.8%

4.1.5 Observed Challenges

Turning to the observed evidence on challenges with the current practice, all students have to be attended by the coordinator before starting applications for field attachment. Students are provided with introduction letters to send together with their applications documents. Students also report back the feedback of applications to the coordinator who then records the feedback. Most students do not receive any feedback until the time of going to the field and leave the coordinator with missing information. It is always a challenge for the coordinator to fulfil the coordination duties such as allocation of supervisors without having complete students allocation information.

4.1.6 User Stories

In a storytelling workshop, the majority of participants showed their wish to be able to get information about organizations and timely feedback after they have applied. They further suggested reporting features that are friendlier for them as students. The main reasons for their suggestions were to allow them to apply to relevant companies, to allow them to confirm or apply to other companies and to ease the process. Key features suggested by students are as presented in Table 5.

Table 5: User Stories (Students)

Story ID	User stories
US1	As a student, I want to be able to get information of available organizations in the system and apply through the system
US2	As a student, I want to be able to sign up and registered in the system so that I can do follow up for the feedback
US3	As a student, I want to be able to see all available organizations so that I can choose one to apply
US4	As a student, I want to be able to share my weekly reports to supervisor so that he/she can comment on my progress
US5	As a student, I want to be able to receive timely feedback so that I can confirm to attend or apply for other organizations if rejected
US6	As a student, I want to be able to search for organization based on location, field of study, main activities so that I can get list of organizations only from places that I can manage to go and relevant to my career
US7	As a student, I want to be able to view organization structure and main activities of an organization so that I can apply to places where my career fits
US8	As a student, I want to be able to view the number of vacancies and the number of students who already applied so that I can assure my chances of getting
US9	As a student, I want to be able to fill weekly reports and print a weekly report from the system so that I can have my weekly reports.
US10	As a student, I want to be able to view my application status so that I can know if I have been accepted or not

The main key features suggested by companies' side were to be able to receive applications of students and view their relevant information for allocation decision purposes. Table 6 show user stories from companies which were involved in requirements elicitation.

Table 6: User Stories (Companies)

Story ID	User stories
US1	As a field attachment host, I want to be able to specify my requirements by selecting from the list so that I can select appropriate requirements when advertising posts through the system
US2	As a field attachment host, I want to be able to view the profile of students who applied and select the appropriate action so that I can do the selection
US3	As a field attachment host, I want to be able to rate the students according to their performance and write suggestions to higher learning institutions

Coordinators came up with features that will help to facilitate their coordination duties. The main features suggested by coordinators were related to reports generation and analysis of allocation status for easy follow-up of their respective students. The features were analysed into users' stories as presented in Table 7.

Table 7: User Stories (Coordinators)

Story ID	User stories
US1	As a coordinator, I want to be able to receive the hosts' assessment report through the system so that I can easily compile
US2	As a coordinator, I want to get students' profiles and locations through the system so that I can have their locations and contacts information
US3	As a coordinator, I want to be able to allocate supervisors to students based on locations, that is region or district
US4	As a coordinator, I want to get students' allocation information so that I can easily follow up
US5	As a coordinator, I want to be able to post adverts for organizations that submit to me vacancies and they have no access to systems so that I can uniformly coordinate
US6	As a coordinator, I want to be able to select students for organizations that submit to me vacancies and they have no access to systems so that I can uniformly coordinate
US7	As a coordinator, I want students to be able to confirm for only one organization so that I can easily follow up

Together these results offered significant insights into the improvement of the current process. The results suggested that having a system to link higher learning institutions,

students and companies which offer field practical training will help to address the current challenges.

Based on the results, both functional and non-functional requirements for the proposed portal were identified. Functional requirements are what the module will offer to users whereas non-functional requirements explain the quality features of a portal.

4.1.7 Functional Requirements

Further analysis of user stories resulted in different functional requirements that will accomplish defined tasks in each user story. The functional requirements can be defined as what the system should do. The results show that the portal should interface with several external actors and systems to implement the following functions:

REQ-1: **Registration:** Registration function involves:

Registration of students

Registration of companies

Registration of HLIs

REQ-2: **Allocation:** Allocation function involves:

Allocation of supervisors

REQ-3: **Information Update:** This function involves:

Filling arrival declaration note

Update students' selection status

Confirmation to attend field attachment

REQ-4: **Report Generation:** Reports generation function involves:

Allocation reports for students and supervisors

Students' profiles

Company profiles

REQ-5: **Reporting:** Reporting function involves:

Uploading reporting templates

Downloading reporting templates

Filling and uploading reports

REQ-6: **Advertise field attachment:** Advertising function involves:

Posting available field attachment posts

REQ-7: **Information searching:** Information searching function involves:

Searching companies

Searching students profiles

REQ-8: **Applications processing:** Applications module function involves:

Sending application documents to companies

View applicants profiles

Making selection of students

4.1.8 Non-functional Requirements

Non-functional requirements are what describe the quality attributes of the system. To accomplish the functional requirements, there are a number of non-functional requirements that the system (FAMS) need to conform to. The following are non-functional requirements for FAMS.

(i) The system should be platform dependence

Users of the system must be able to use both computers and smart phones to open the system. This implies that the system should be able to run under windows platform, android operating systems and under Linux operating systems with minor configuration changes. To allow working properly under android smart phones, responsive design is suggested to fit different screen sizes and rotations.

(ii) The system should work with Graphical User Interface (GUI)

Due to the objective of the system, it should work with Graphical User Interface (GUI) as it is expected to be used by users of diverse knowledge. This will give the advantage of easiness for non-technical users.

(iii) The system should be a web-based application

The system should be a web-based application to make it reachable from anywhere provided the network connection is alive.

(iv) The system should allow automatic data clearing for saving the storage capacity

The system links all stakeholders of field attachment. This implies that the system will accommodate a huge amount of data including, students' information, companies' information and HLIs' information. To handle this huge amount of data, users' information will be given a time stamp and automatically be deleted from the system after a specified period of being inactive.

4.1.9 Conceptual Workflow

The results suggest that the platform should allow companies to advertise available chances to host students for field practices by providing information such as location, number of students and category of study which students may get chance to learn. Companies also should be able to receive applications from students and process them as well as reporting students' performance back to universities.

Regarding universities, it was thus suggested that coordinators should be able to use the system to allocate supervisors based on available students' allocation information. Moreover, they should be able to provide reporting formats, view and compile reports from companies and supervisors. Not only that but also, students should be able to view information of available companies, search for relevant companies, apply and follow up for feedback. They should further be able to update their allocation information and submit reports to their respective supervisors. Conclusively, supervisors should be able to follow up on students, view, comment on and compile reports of their respective students. The flow of information to the system and reports that the system will provide is as shown in Fig. 9.

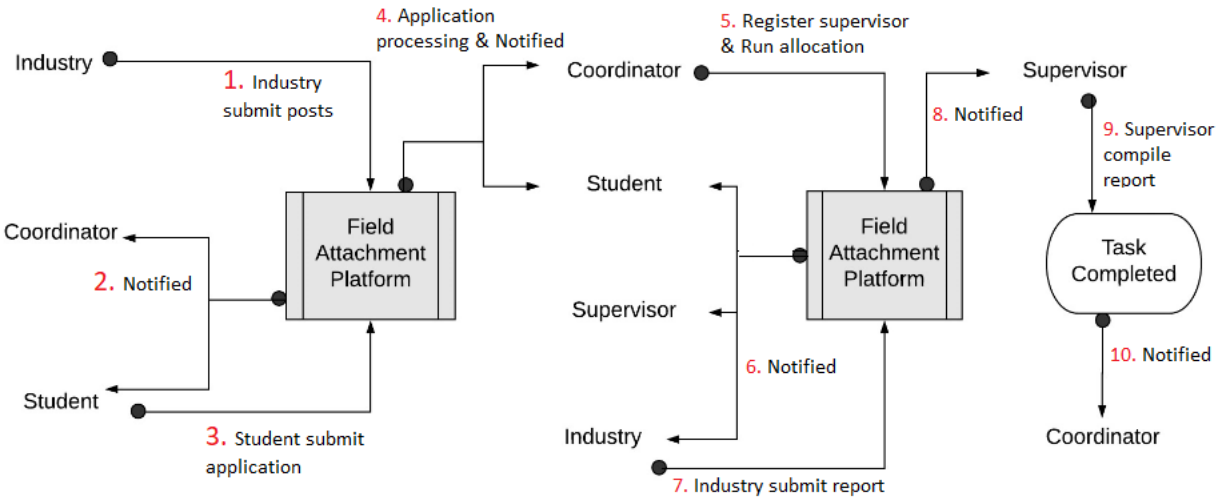


Figure 9: Conceptual Workflow for Field Attachment System

4.1.10 FAMS Process Model

As opposed to the current process where field attachment management and coordination involve a lot of paper-based works, the developed system (FAMS) reduces the manual works starting from making companies' information available, linking students to relevant companies and other value-added services like reports generation, location updating and open doors for more collaboration between HLIs and companies. Figure 10 illustrates the process model for the FAMS.

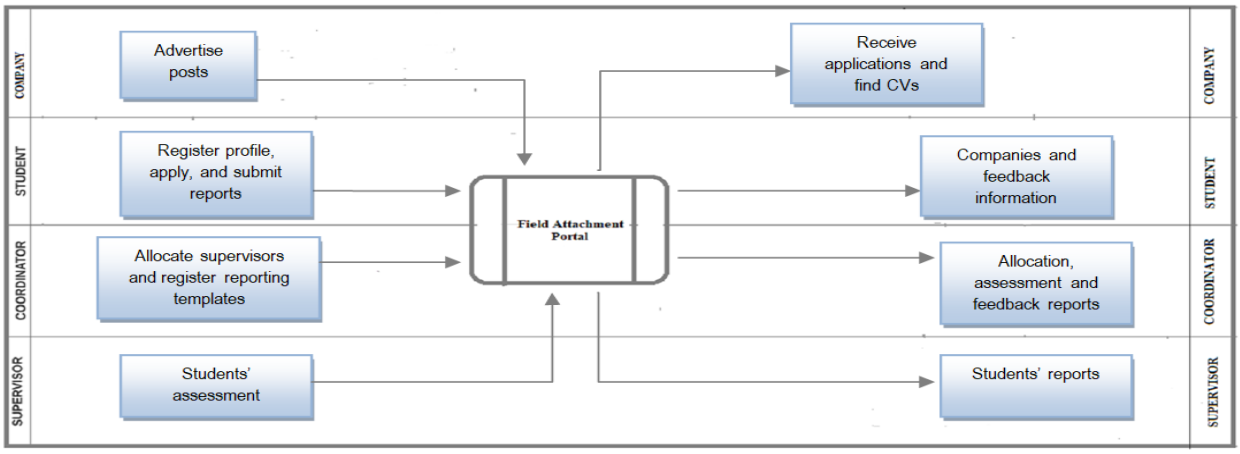


Figure 10: FAMS Process Model

4.1.11 Use Cases

Categories of users who will have access to the system (FAMS) are HLI students, companies, coordinators, supervisors and an administrator. Use cases allow the description of events sequences of a system and users interaction points that are taken together for a system to do

something useful (Bittner & Spence, 2003). They further indicate the conditions and when a certain system's behaviour occurs. Expression of system's behaviour by using use cases, facilitate understanding of the requirements. Use cases were employed to best describe the requirements of the system.

(i) Use Case Diagram

Users will interact with the system as illustrated in Fig. 11.

Figure 11: Use Case Diagram

(ii) Use Cases Description

The description of use cases indicated in use case diagram is as per Table 8.

Table 8: Use Case Description

Use case	Description
Register for an account	An administrator will be able to register higher learning institutions and that account will be used by a field attachment coordinator. The field attachment coordinators will be able to register supervisors and pre-required information of eligible students. Students will complete their registrations after their pre-registration information be available in the system while companies will be able to register themselves for an account.
Login	All users will have to log into the system using username and password. Users will also be able to recover accounts with forgotten passwords.
Post advertisement	Companies will be able to advertise field attachment posts by specifying field area, location and number of students they can host.
Send an application	Students will be able to send their applications to different companies.
Upload templates	Field attachment coordinators will be able to upload reports templates according to their specific reporting requirements.
Allocate supervisors	Field attachment coordinators will be able to allocate supervisors to a number of students based on locations where students are doing their field practices.
Fill reports	Students and supervisors will be able to fill and submit their respective reports.
View reports	Supervisors and coordinators will be able to view reports from students and students allocation reports
Update information	Companies will be able to update students' application status. Students will be able to update changes in location for field attachment and confirmation to attend field attachment to a company.
Manage users	An administrator will be able to add higher learning institutions (HLIs), grant and revoke access to HLIs

4.2 Design

In wireframe prototype responses, it was observed that there is a need to rearrange some links, add new features and change the language used to give different information. One student commented that adding a feature to rate companies after field attachment will help the coming students to make the right choice. For the side of companies, the major comment was to further simplifying advertising procedure by introducing a requirements selection form

where companies would select appropriate requirements when they post advertisements. Moreover, one coordinator suggested an improvement of reporting by allowing upload of reporting templates during university registration and to make changing possible if the reporting template is reviewed. The other coordinator commented that giving students ability to edit their information helps coordinators and supervisors to have the correct allocation information.

The final prototype accommodated all inputs from respondents. As a result, the final system interface, data model and system architecture was designed to fit all the required features as follows:

4.2.1 System Interface

The resulting User interface (UI) after accommodating feedbacks from users who were involved in prototype testing is as indicated in Fig.12. The use of Graphical User Interface (GUI) in the final interface design was observed to have improved usability of the designed interface and users could easily realize where to find different functional features.

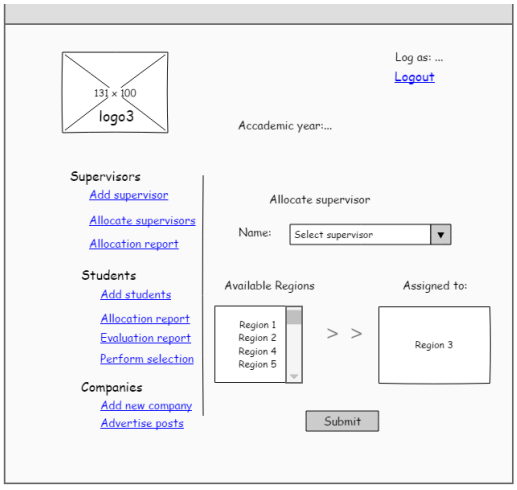
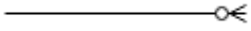
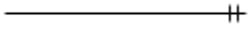


Figure 12: Interfaces Designed Using Pencil Software

4.2.2 Database

Database for FAMS was designed using the Entity-Relationship Diagram (ERD). ERD is high level description of entities, attributes as well as relationships between entities (Btoush & Hammad, 2015). Numbers of standard notations are available in drawing ERD. The Chen ERD notation was applied in this study. Chen's notation uses oval to symbolize attributes, a rectangle to symbolize entities, diamond between two entities to symbolize type of

relationship and put degree of relationships between entities. Definitions of symbols used to draw an ERD are as follows:

Symbol	Meaning
	Entity
	Attribute
	Action/Relationship
	Zero or Many
	One or Many
	One

Although some database features were improved periodically based on the result of acceptance testing at the end of each system increment, Chen ERD notations were used to represent an initial design of a database that was developed to guide implementation of data-driven features. Designed ERD was composed of 13 entities with defined relationships between them as shown in Fig. 13.

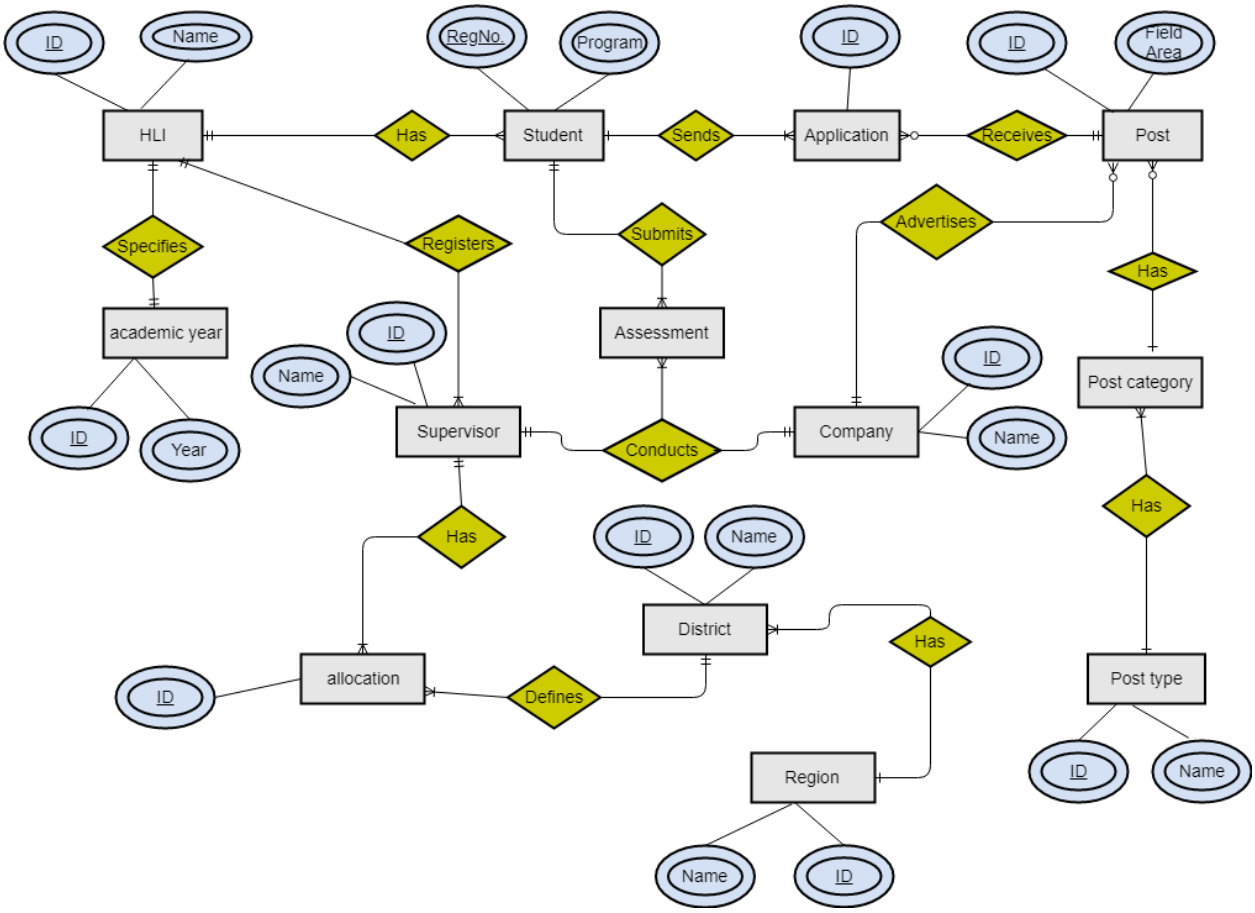


Figure 13: ERD for FAMS Database

4.2.3 System Architecture

The client-server system with user interface and server-side composed of application and database servers was determined to best accommodate the portal. The resulted architectural design allows companies, HLI students, coordinators and supervisors to use computers or smart-phones connected with internet to open the portal. It further gives users an ability to read from and write their particular information to a database after they log in. Moreover, it makes advertised field attachment posts visible to students in all registered HLIs and companies are able to receive the applications for their respective advertisements. Not only that but also, with this architecture, HLIs are able to coordinate and manage their respective students' information from the database. The FAMS architectural layer design is as indicated in Fig. 14.

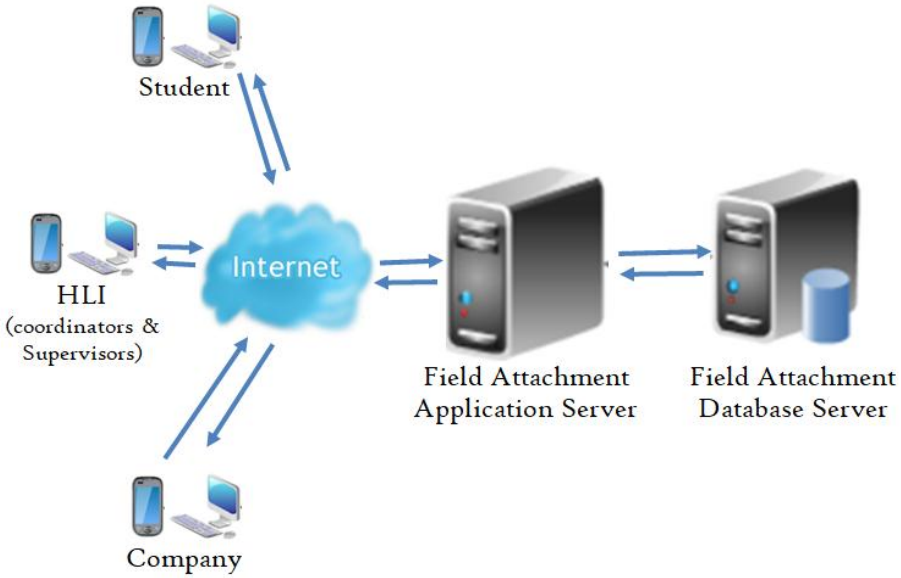


Figure 14: FAMS Architectural Layers Design

4.3 System Implementation

4.3.1 Database Implementation

Database implementation was done by first breaking the composite attributes to simple attributes; define new attributes to enable capturing of all important information and defining data type of each attribute to be recorded into the database. Database Management System (DBMS) applied to implement a database was MySQL while administration tool that was used is phpMyAdmin. PhpMyAdmin is a free web application created using PHP script to provide convenient GUI environment for users to interact with MySQL databases. Among other advantages, it has feature that allows searching of objects in the entire database or specified tables, importing and exporting data that are in Structured Query Language (SQL), Extensible Mark-up Language (XML) and Comma-separated Value(CSV) formats. The developed MySQL database schema for FAMS is as depicted in Fig. 15.

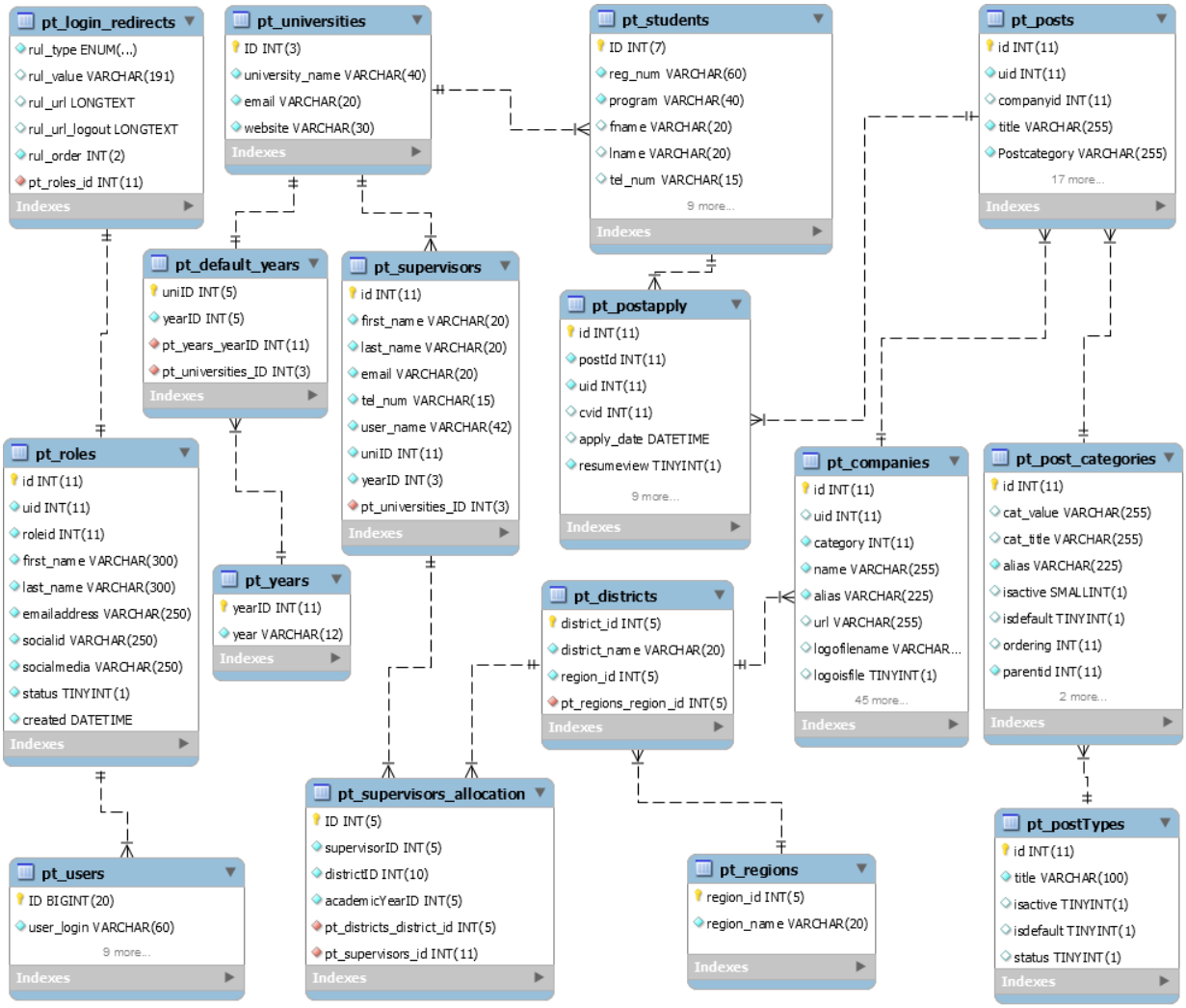


Figure 15: Database Relational Schema

4.3.2 Functional Features Implementation

The portal is intended to be used by four stakeholders who are companies, HLIs students, coordinators and supervisors. Companies can register for an account through a registration link available on FAMS homepage. Furthermore, for the side of other stakeholders, registration is initiated by an administrator who is responsible for registering HLIs. After HLI being registered, a coordinator can use an account to register supervisors and add a list of eligible students in that specific HLI. Students can accomplish registration and open an account only after their registration numbers are uploaded into a system by a coordinator. Student's registration is done by selecting HLI, registration number and fills other information like names and contacts. Figure 16 shows the home page interface on which user can navigate through a login link, new companies and students' registration links.

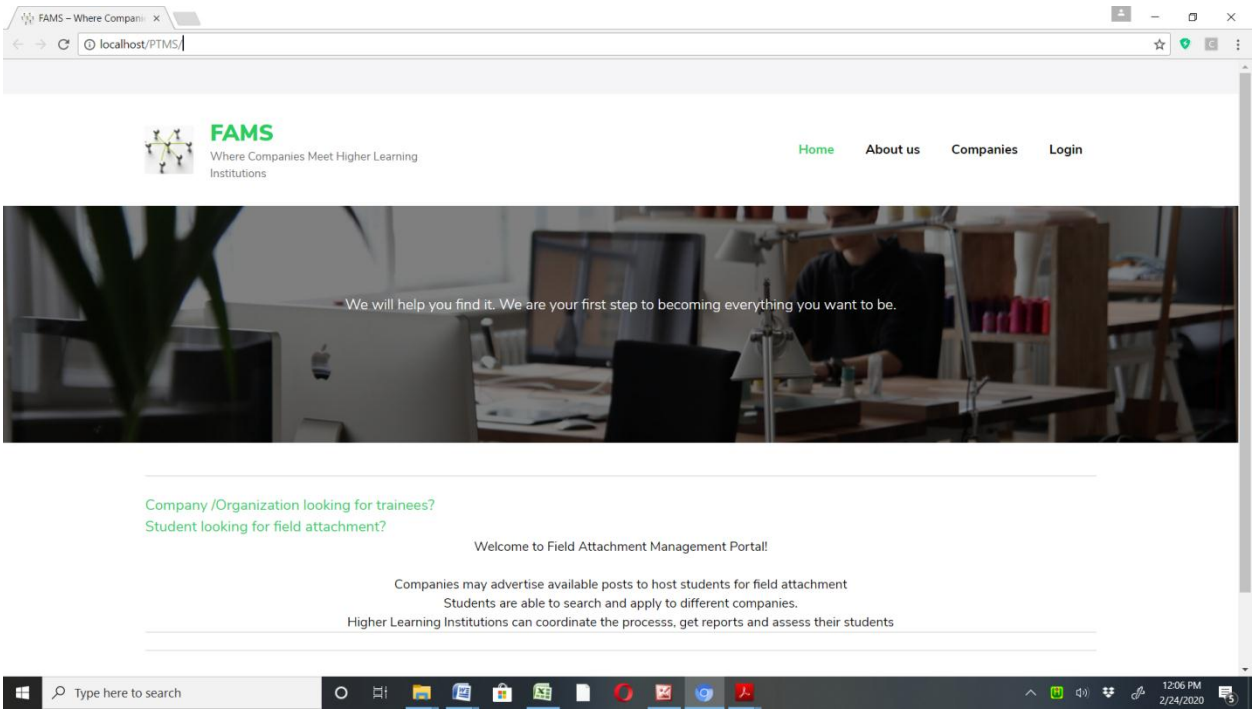


Figure 16: FAMS Home Page

After login into a system, user is automatically directed to a page based on the role. On a role-specific page, user can use a system to accomplish number of activities concerning field attachment, view and download different reports. Features of a developed portal according to user's role are as follows:

(i) Coordinator

The coordinator can add a list of eligible students into a system. Information added is registration number and study program. Two options are available; either to upload a Comma-separated Value (CSV) files containing students' information or typing information in the form and submit as shown in Fig.17. Regarding students, coordinator can also view students' allocation report and upload templates for students, reports.

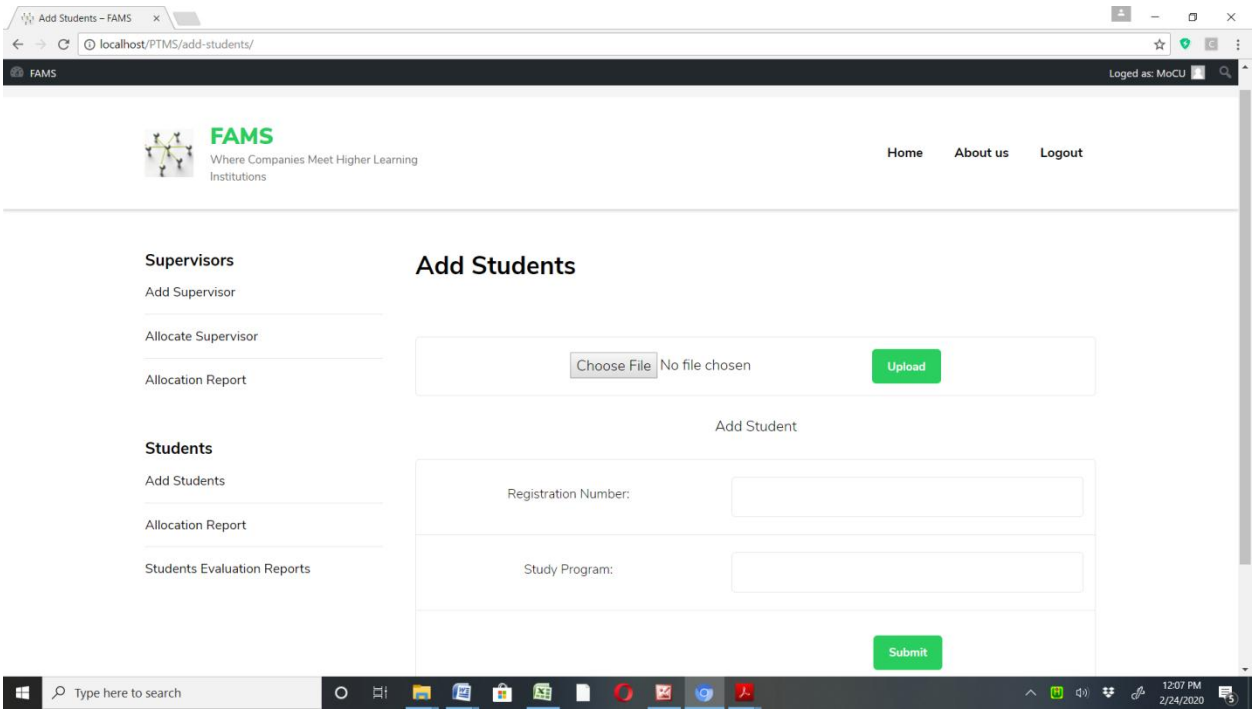


Figure 17: Form Options for Adding Eligible Students

By using the developed portal, the coordinator can add lecturers who will supervise students in field attachment. Moreover, allocation of supervisors can be done at district level where after being assigned to a specific district, supervisor's information is reflected to all students who are doing their field attachment at that specific district. The coordinator can also get supervisors' allocation report which is downloadable in CSV format. The list of students who are assigned to a selected supervisor can also be downloaded as shown in Fig. 18.

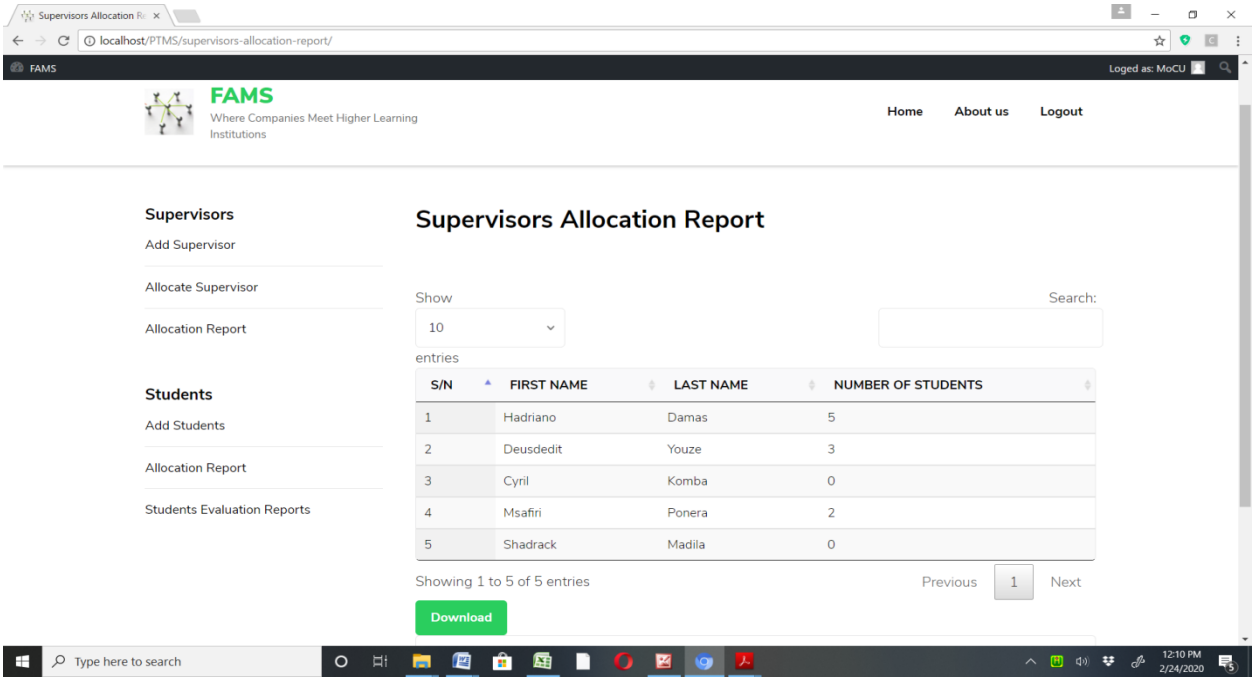


Figure 18: Supervisors' Allocation Report as Viewed by the Coordinator

(ii) Supervisor

FAMS can be used by supervisors to facilitate the whole supervision exercise starting from getting information of students allocated to. The supervisor can get a list of students allocated to supervise as well as location and contact information of the companies as depicted in Fig. 19.

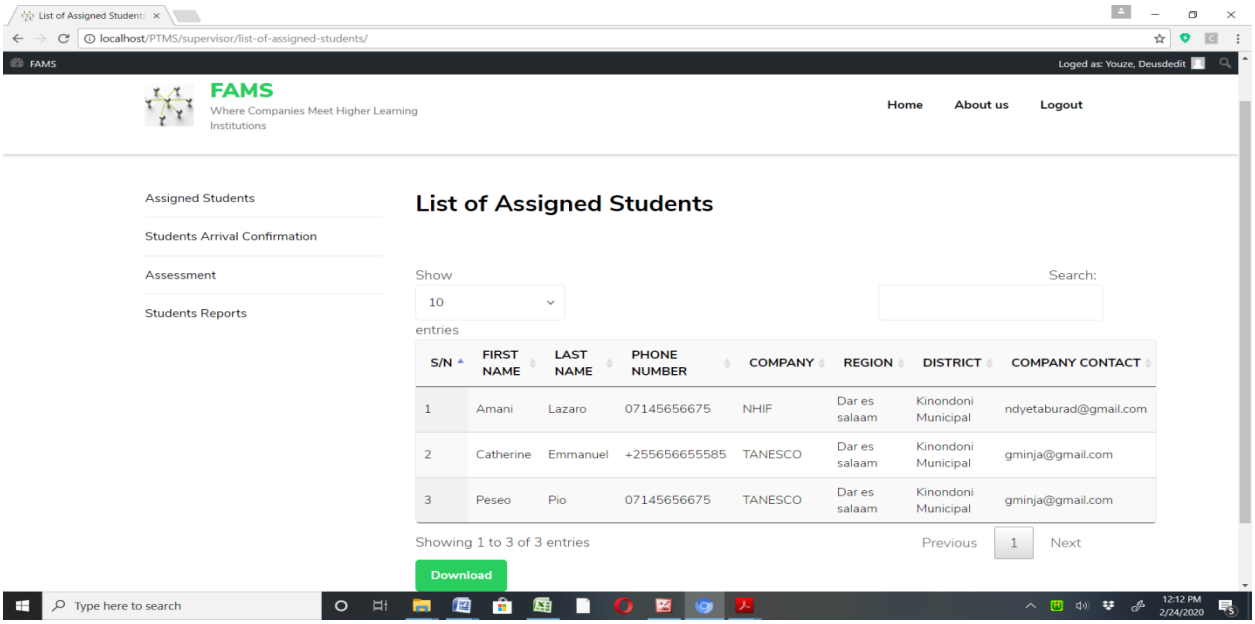


Figure 19: Detailed Information of Students Assigned to a Supervisor

FAMS also enables supervisors to fill students' assessment forms. Assessment option allows supervisor to view the assessment status of all allocated students. If the assessment for a specific student has already been done, the assessment link before a student in a list is becoming inactive while the link is active for those who are not ready. After selecting a specific student to assess, downloading and uploading options for assessment form are displayed to allow a supervisor to use a template submitted by the coordinator. Figure20 shows list of students with an option for a supervisor to conduct an assessment.

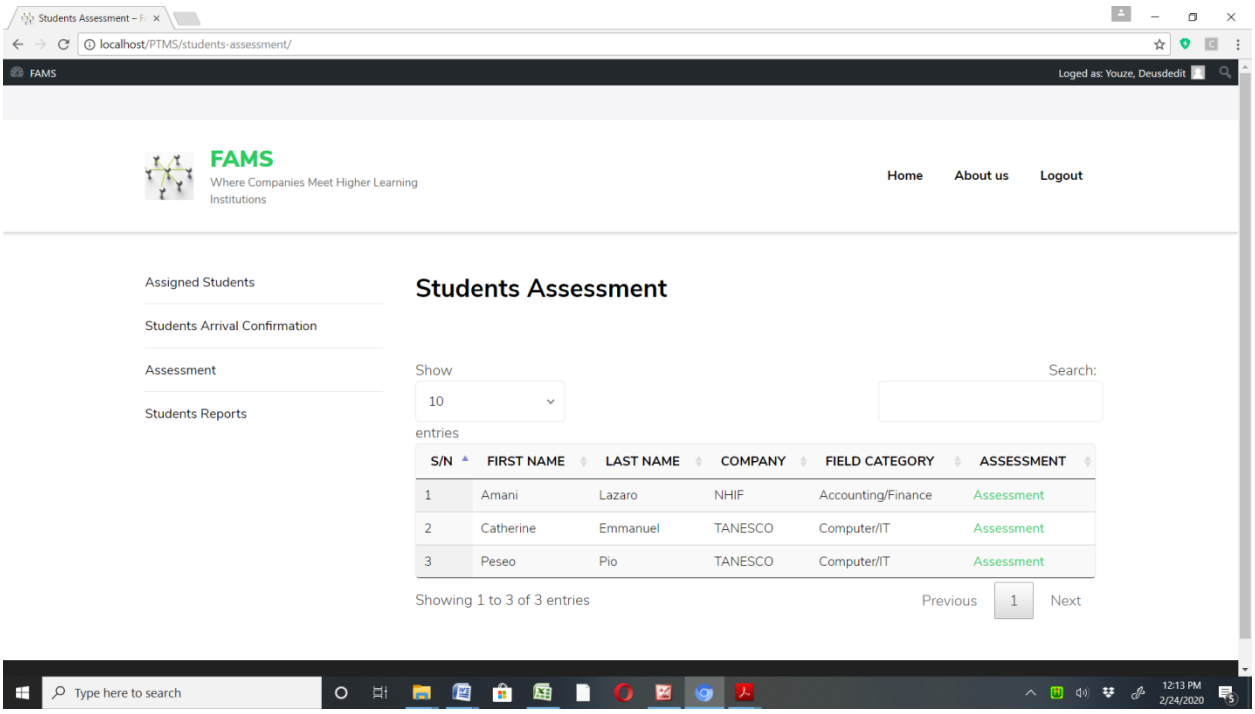


Figure 20: List of Students to be Assessed

After selecting an assessment link, a supervisor can download an assessment form, fill it and submit by uploading through the system using available options as shown in Fig.21.

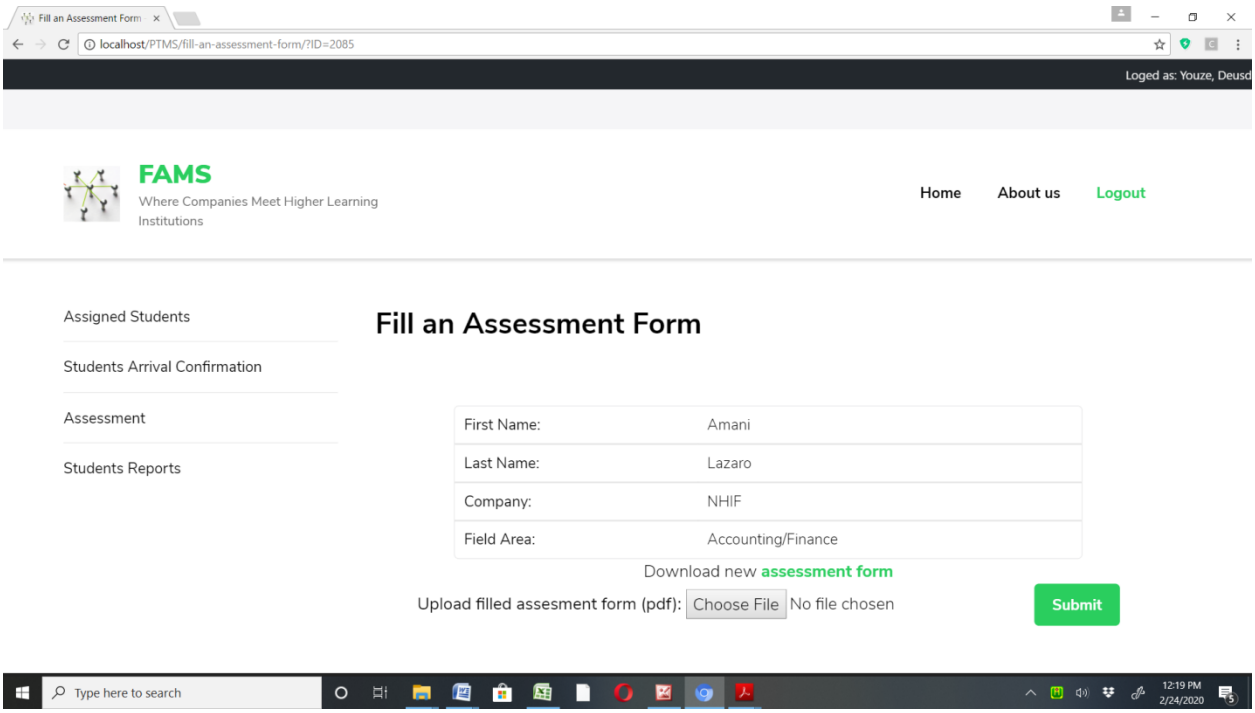


Figure 21: Assessment Form's Downloading and Uploading Options

(iii) Company

After a successful login with company account, FAMS opens a web page that provides a user with company dashboard. The company dashboard gives graphical representation of links for adding field posts, viewing status of existing posts, and searching students' resumes and profile as depicted in Fig. 22.

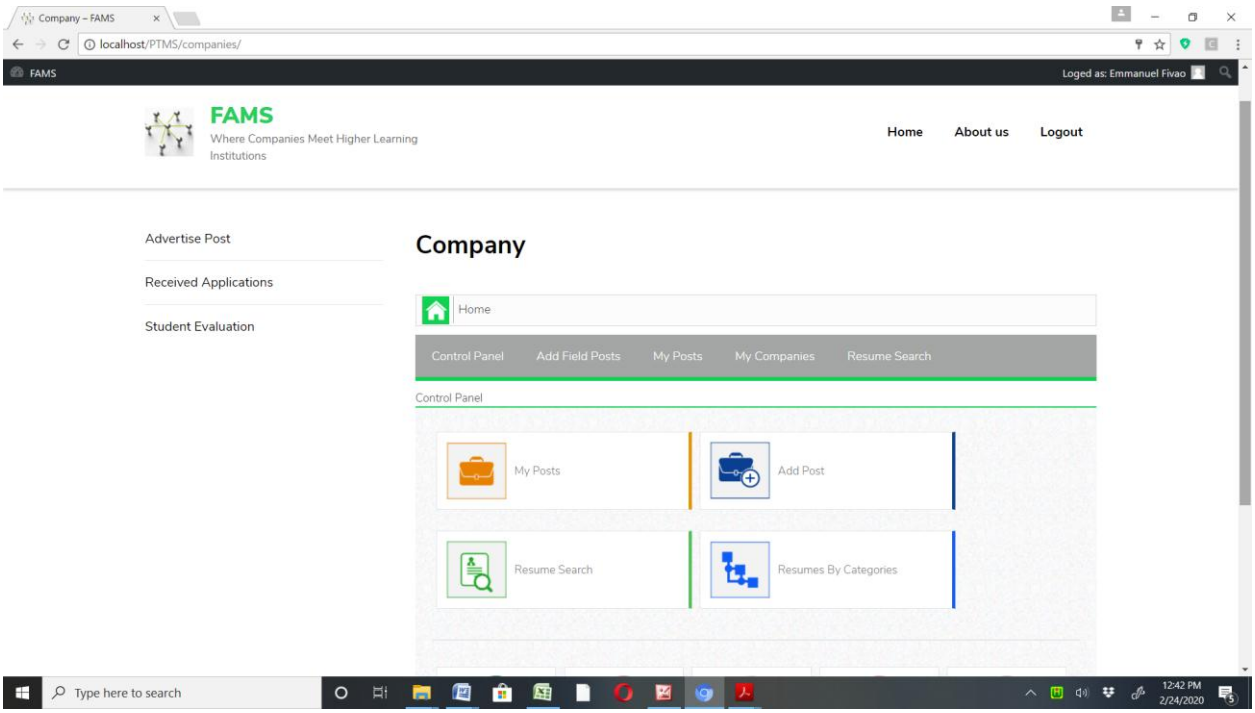


Figure 22: Company's Home Page

After students have submitted applications for field attachment, the company can use posts link to view details and application documents submitted by students. The link displays list of all posts advertised by that company showing number of resumes that have been received for each post. Figure 23 shows number of resumes received for field attachment at accounts section (which in this case is 1 resume).

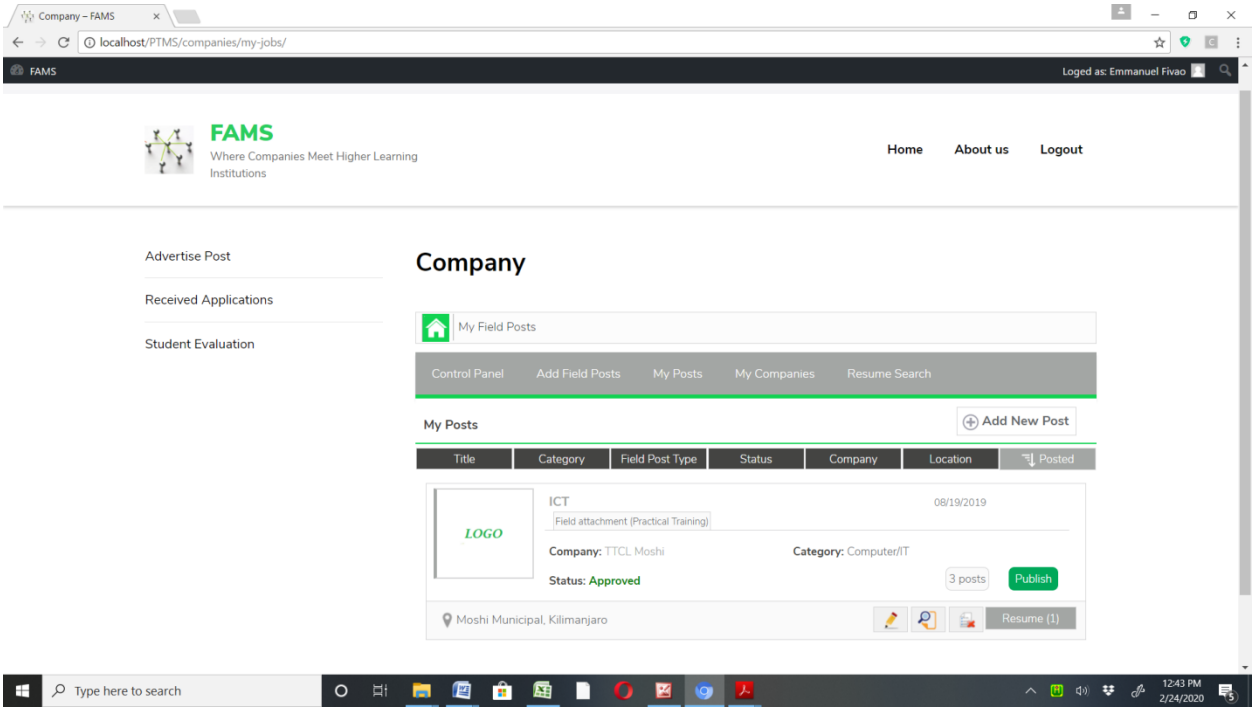


Figure 23: A Field Attachment Post Showing the Number of Resumes Received

Moreover, a company can use a resume link to view profiles of all applicants and make selection decision for one applicant after another. The selection decision made by company can be viewed by an applicant (student). To reject an application, company has to choose a reason for rejection which can be irrelevant study program, allocation is fully or other reasons. Figure 24 shows an interface for applicants' selection decision.

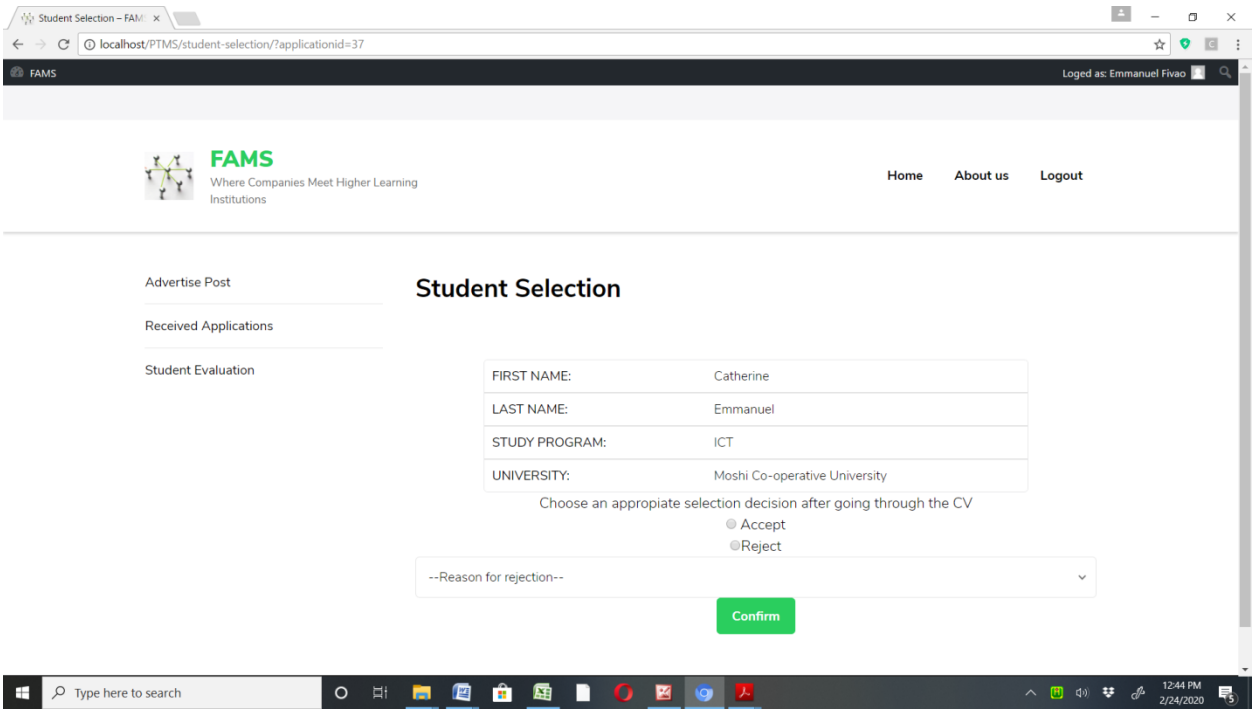


Figure 24: Interface for Applicants' Selection Decision

(iv) Student

FAMS enables students to get information of relevant companies to do their field attachment, search and apply for field attachment based on their preferences and make a follow-up of their applications. In each new post available in a system, students have access to apply link which enables them to fill some information and send applications to companies of their choice. Figure 25 shows available post with location information, study category, number of students company can host and a link to send an application.

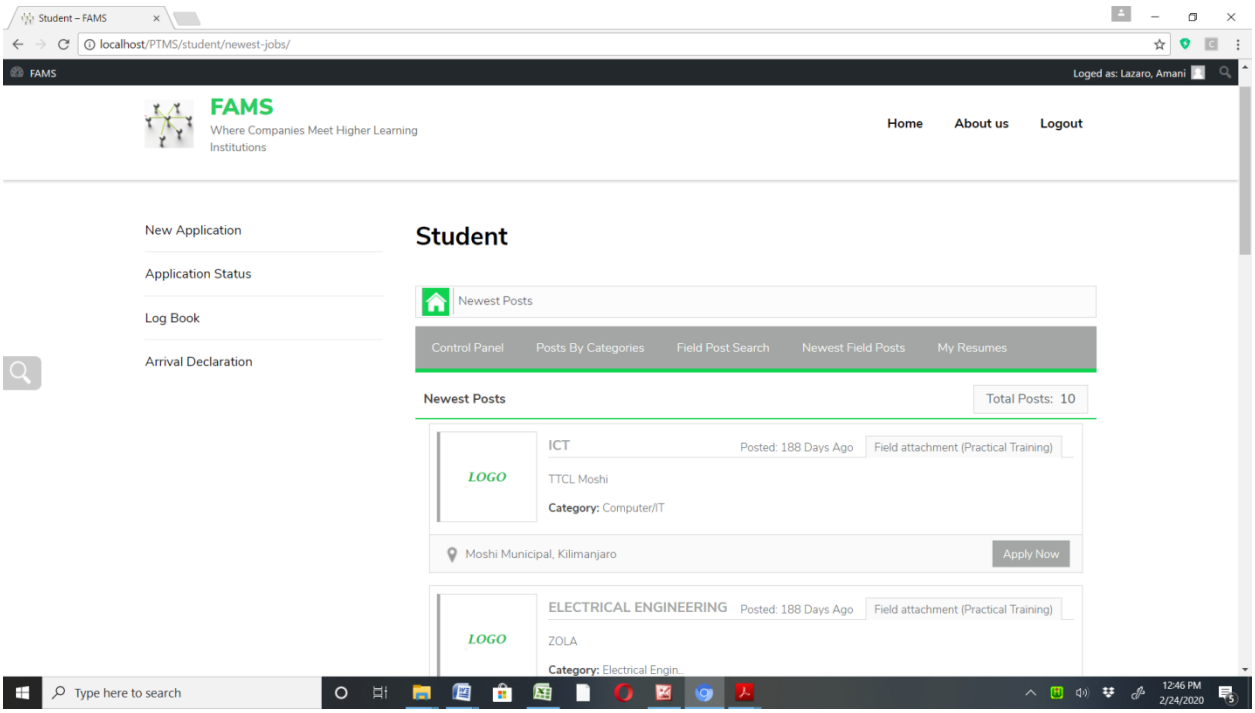


Figure 25: Available Posts' Information Display

After sending applications to one or more companies, FAMS facilitates students to make a follow-up of their application status. The status of an application can be submitted, accepted or rejected after selection. For an accepted application, confirmation link is made available for a student to confirm attendance of field attachment to that specific company. Follow-up of an accepted application showing confirmation link is as depicted in Fig. 26.

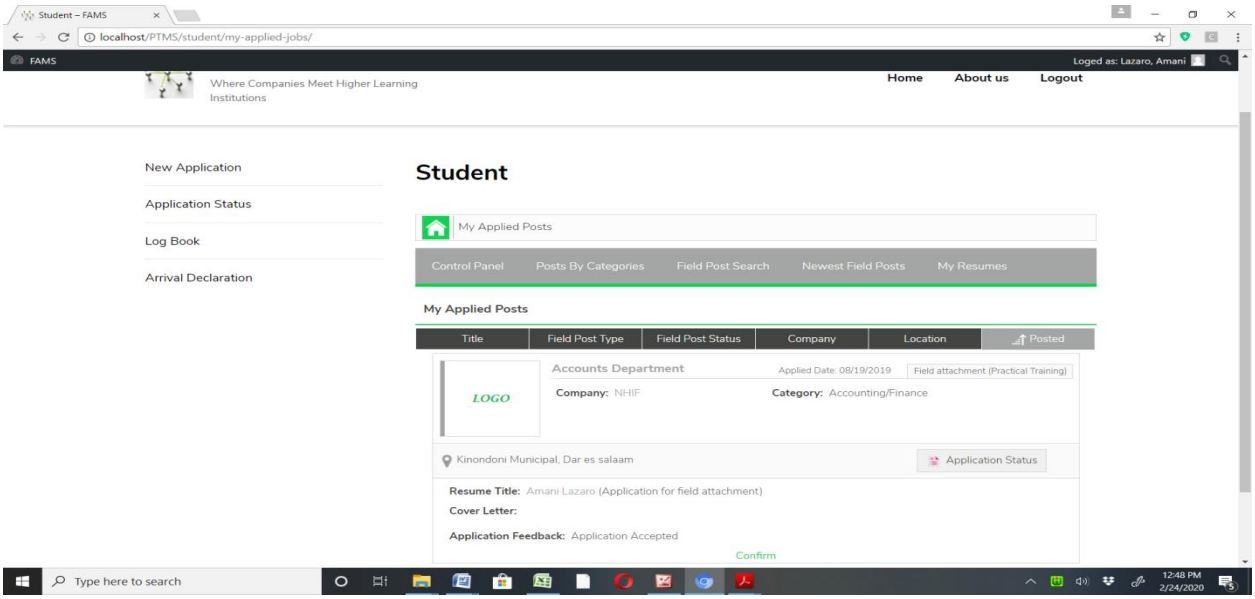


Figure 26: Follow-up and Confirmation Links for the Accepted Application

All FAMS features can be displayed on computer devices with different sizes and orientations. To further confirm if all features are working as it was intended and meet users' expectations and acceptance criteria, validation and usability testing was done. The testing results were as presented in the following chapter sections.

4.4 Validation

The running portal, Field Attachment Management System (FAMS) was finally tested for usability in July and August 2019 with a total of 35 members of a target group. The distribution of testers was 20 HLI students, 5 coordinators from HLIs, 5 supervisors from HLIs and 5 companies' representatives. During the testing session, test participants were observed as well as requested to respond on usability testing questionnaires. Prior to usability testing, pilot testing was conducted to determine the possible time that testers might take to accomplish a task scenario. The main purpose was to assess the usability strengths and weaknesses of a developed portal. The findings and recommendations from the test are as in the following subsections.

4.4.1 General Findings

(i) All functions were tested and found that are working properly and consistently

Testing of the major functionalities was conducted to see if the developed system (FAMS) meets the expected goal as well as its behaviour regarding different inputs. Real data was used to conduct the test. The testing conducted involved, registration of users, posting advertisements, sending applications, searching for applicants' profiles, uploading and downloading of different reports. The results of test were as per designed test cases which were used to measure the correctness of systems' functionalities. It was found that all functions worked properly and consistently as shown in Table 9.

Table 9: Validation Test Cases Results

Features	Test cases	Status
User registration	Check for correctness of users' information	Pass
User login	Check for users' authorization requirement	Pass
Upload list of students	Check for the requirement of file with correct information	Pass
Add supervisors	Check for correctness of supervisors information	Pass
Post advertisement for field attachment	Check if an advertisement must have all important information	Pass
Allocate supervisors	Check if supervisors' allocation reflects to all intended students	Pass
Apply for field attachment post	Check if application documents correctly sent to a specific company	Pass
Search for a company	Check if all available companies which meet the search option can be viewed	Pass
Submit report	Check if the report can successfully be submitted	Pass
Download allocation report	Check if allocation report is successfully downloaded	Pass
Upload reporting templates	Check if report templates can successfully be uploaded	Pass
View applicants profiles	Check if all applicants profiles are accessible	Pass

(ii) Most of the test participants found to have experience of using computer and online application portals

Test results can greatly be influenced by a number of characters of users who are involved in testing. To determine the impact of type of users who were involved in testing, a pre-test questionnaire was used to understand types of test participants. Among others, experience of participants on using computer, their frequency on using computers and experience on any online application portal were recorded. It was found that test participants selected were the right users to test the portal and even those 9% who had shown to have no experience on

using online application portal managed to use FAMS at first place. The results of experience of all 35 test participants are as indicated in Fig. 27.

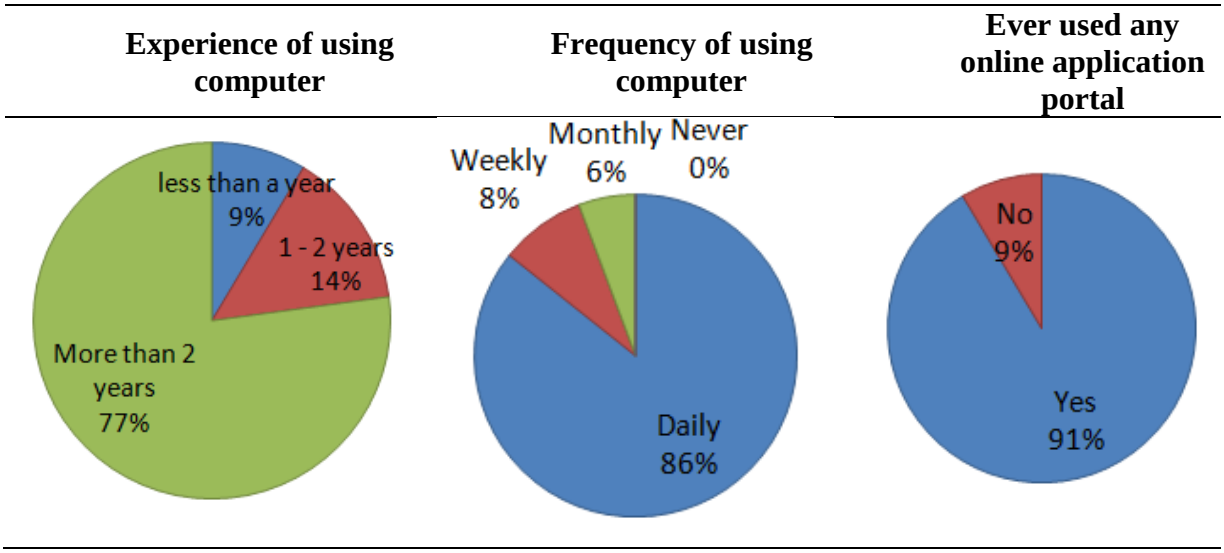


Figure 27: Experiences of Test Participants

Turning to the experience of individual categories of participants, it was observed that most of test participants who were found to have less experience are from HLI students group. Table 10 is a summary of findings categorized into individual groups of test participants.

Table 10: Experience of Individual Groups of Test Participants

S/No	User character	Response	Users' Category							
			Students		Companies		Coordinators		Supervisors	
			Count	%	Count	%	Count	%	Count	%
1.	Experience on using computer	Less than a year	3	15%	-	-	-	-	-	-
		1 – 2 Years	4	20%	1	20%	-	-	-	-
		More than 2 years	13	65%	4	80%	5	100%	5	100%
2.	Frequency on using computer	Daily	16	80%	5	100%	5	100%	4	80%
		Weekly	2	10%	-	-	-	-	1	20%
		Monthly	2	10%	-	-	-	-	-	-
		Never	-	-	-	-	-	-		
3.	Ever used any online application portal	Yes	17	85%	5	100%	5	100%	5	100%
		No	3	15%	-	-	-	-	-	-
4.	Device normally used (Multi response)	Smart phone	16	80%	5	100%	3	60%	3	60%
		Laptop	11	55%	4	80%	3	60%	3	60%
		Desktop computer	5	25%	1	20%	2	40%	1	20%

(iii) Test participants easily realized what the system is about and where to start

The first task scenario that users were given was to open the home page and tell what they could do with that page. All the participants easily realized that for as long as they are new users, they need first to go to a new user link for registration.

(iv) Participants agreed that FAMS met usability criteria

At the end of each test session, participants participated in filling the systems' usability questionnaire. The post-test questionnaire was composed of 11 usability criteria which users were asked to give their opinions based on the test that they have conducted. Participants were required to tell whether they strongly agree, agree are neutral, disagree or strongly disagree with each of the given usability metrics. The results show that participants were very positive regarding all the usability scenarios as most of them strongly agreed on positive

usability statements and strongly disagreed on counter usability statements. Table 11 presents the results of participants' responses on usability questionnaire of the entire system.

Table 11: Users' Responses on Usability Metrics of the Entire System

Usability Criteria	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The system was easy to use	71.43%	28.57%	0.00%	0.00%	0.00%
I found the system unnecessarily complex	0.00%	0.00%	0.00%	42.86%	57.14%
I think I would need support from technician to use this system	0.00%	0.00%	8.57%	40.00%	51.43%
I found the flow of tasks in this system are well arranged	62.86%	37.14%	0.00%	0.00%	0.00%
There was too much inconsistency in this system	0.00%	0.00%	0.00%	20.00%	80.00%
The system is easy to learn	80.00%	17.14%	2.86%	0.00%	0.00%
The system is very cumbersome to use	0.00%%	0.00%	0.00%	40.00%	60.00%
I needed to learn a lot of things before I could manage to use the system	0.00%	0.00%	0.00%	54.29%	45.71%
It was easy to find information I needed	77.14%	22.86%	0.00%	0.00%	0.00%
I enjoyed using the system interface	74.29%	25.71%	0.00%	0.00%	0.00%
Information provided by the system is easy to understand	88.57%	8.57%	0.00%	2.86%	0.00%

4.4.2 Positive Findings

(i) Students were able to easily send an application to companies for field attachment

All 20 students who were involved in the testing were able to send an application to a company. Moreover, a total of 17 students which is 85% of all students test participants were able to successfully send their applications in less than 5 minutes. This implies that it is easy for students to search for company, process and send an application. Figure 28 shows success rate and time used by testers to send an application.

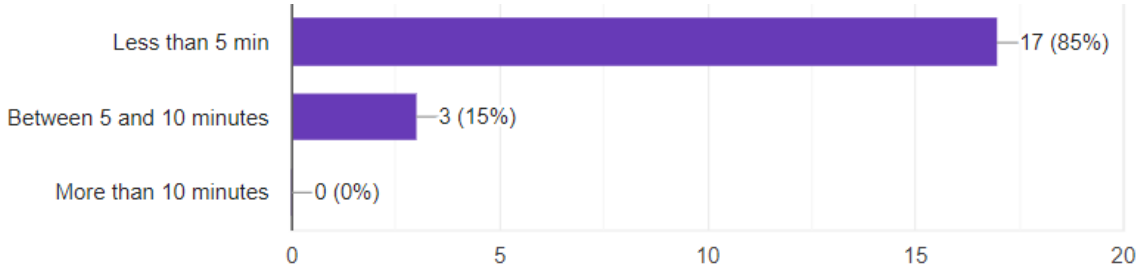


Figure 28: Time Used by HLI Students to Send Applications

(ii) Students easily realized to find a list of companies based on their preferences and study area

All participants could easily recognize the use of search icon while they were on the application page. The search icon gave them a pop up of a refined search option. With a refine search option, participants could search for a study area category as well as company names and specific district where they prefer to go for field attachment. Figure 29 shows the link to a refine search option and its pop-up options.

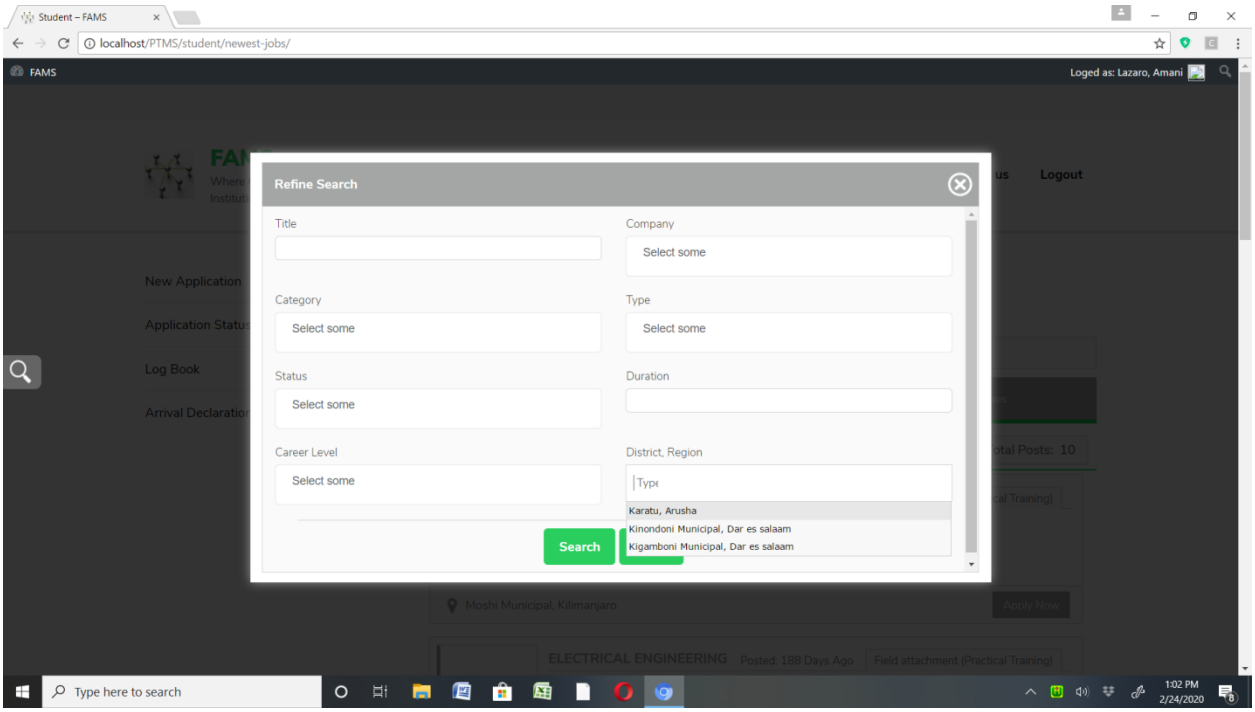


Figure 29: Refine Search Option

With this option, it was easy for testers to see the category of field study that a company offers and details on location and number of students the company can receive as shown in Fig.30.

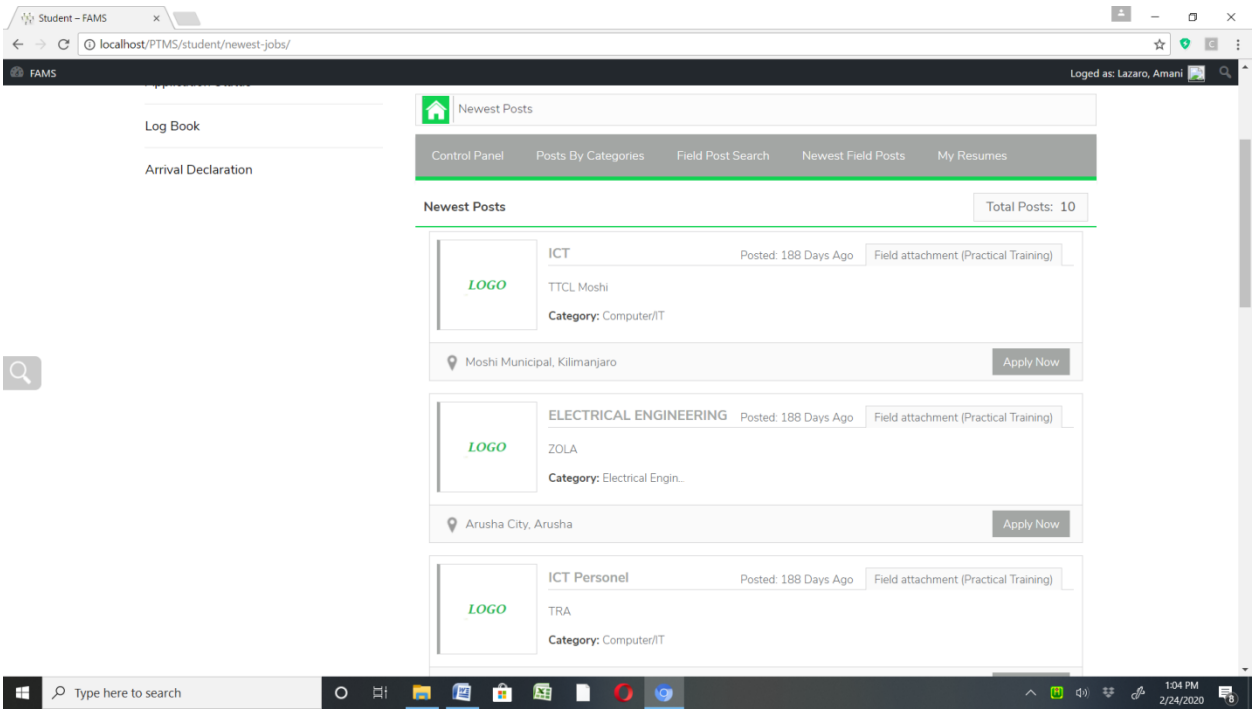


Figure 30: Overview of Field Attachment Posts List

(iii) Students could easily make a follow-up of their applications status

Usability test results recorded regarding users ability to find status information of their applications shows that all participants could do a follow-up and send a confirmation note to company. Participants were observed if they could succeed and time they spent to accomplish a task. The result also shows that 80% of participants were able to make follow-up in less than 5 minutes as shown in Fig. 31.

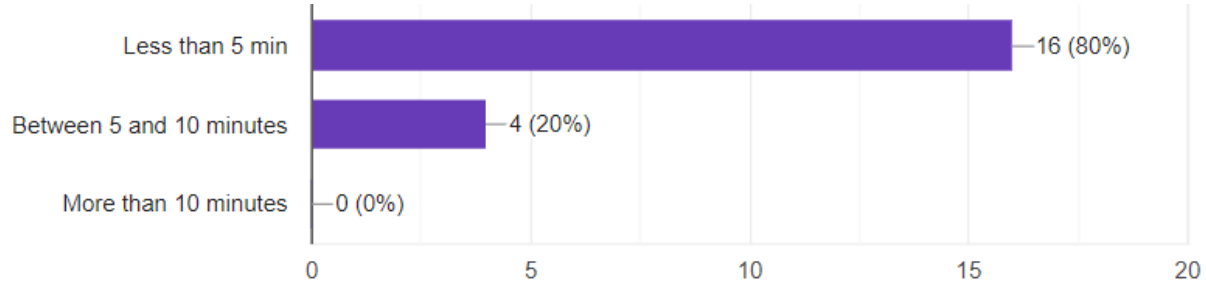


Figure 31: Time Used by HLI Students to Make a Follow-up of their Applications

Follow-up was reported to be one of the challenges with the current practice. The usability test result shows that the challenge is greatly solved by FAMS and applicants can get instant feedback and make decisions accordingly.

(iv) Companies could easily post the advertisement of field attachment posts

The results show that all 5 participated users from companies were able to register into the system and post advertisements of field attachment posts. It was further found that all were able to successfully post field attachment with full details in less than 5 minutes as shown in Fig. 32.

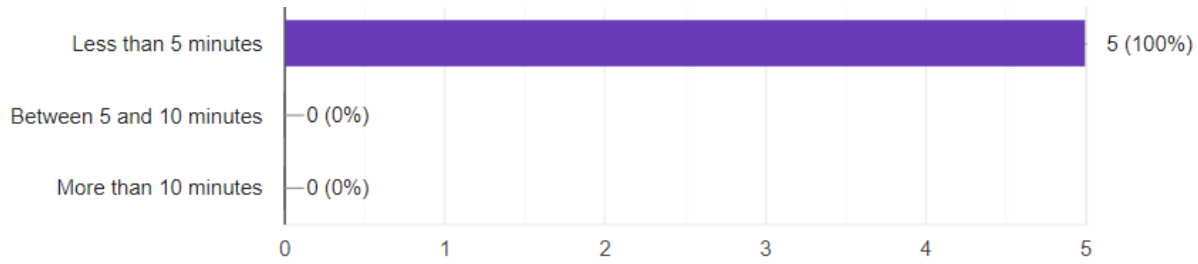


Figure 32: Time Used by Companies to Post Field Attachment Posts

A scenario where a single company has more than one branch was also tested for usability. The participants were asked to post field attachment posts for two branches which are located in different regions. As shown in Fig. 33, the participants could add a branch for a registered company and successfully post an advertisement. The result also shows that additional time spent by participants is reasonable as more details were needed to add a branch for a company.

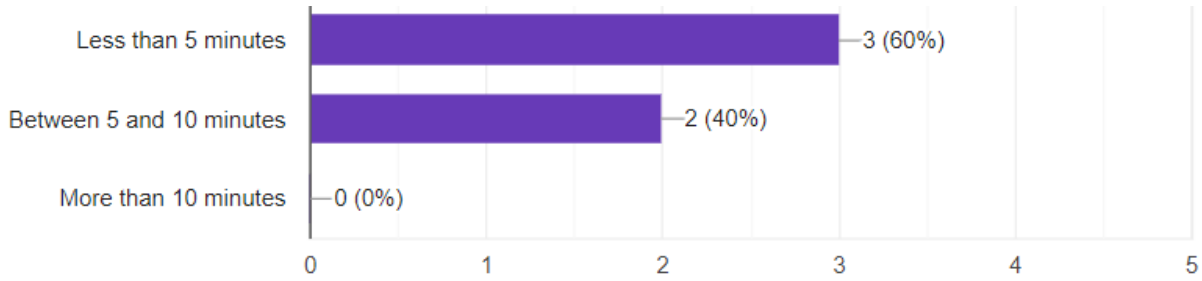


Figure 33: Time Used by Companies to Post Field Attachment Posts for Branches

(v) Companies could easily view applicants' profiles

Participants from companies were also asked to view information that will help them to make selection decisions out of number of applications that they received. The results show that, all participants were able to view applicants' profiles and update the selection status in less than 5 minutes. The summary of findings is as shown in Fig. 34.

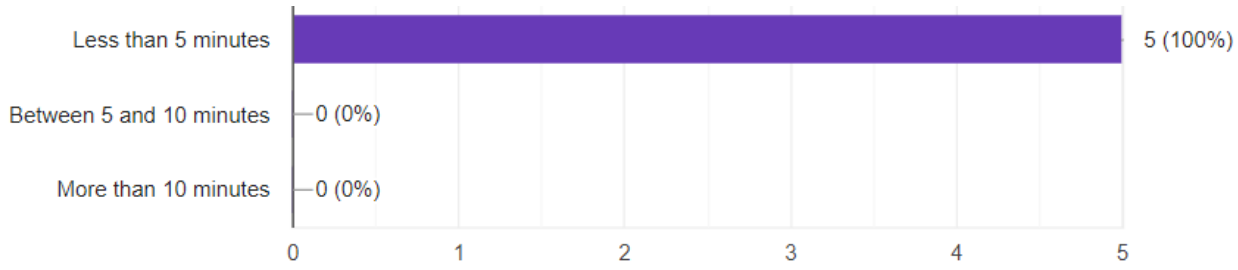


Figure 34: Time Spent by Companies to View Applicants' Profiles

(vi) Field attachment coordinators were able to easily register lists of students and supervisors into a system and view allocation reports

It was observed that, all 5 field attachment coordinators participated in testing were successfully completed the task of uploading list of eligible students, registering new supervisors and downloading supervisors allocation reports. The success was due to a reason that, the information about expected report was available in the system. Figure 35 shows the options for downloading a list of all supervisors as well as the option for downloading detailed allocation report of a selected supervisor.

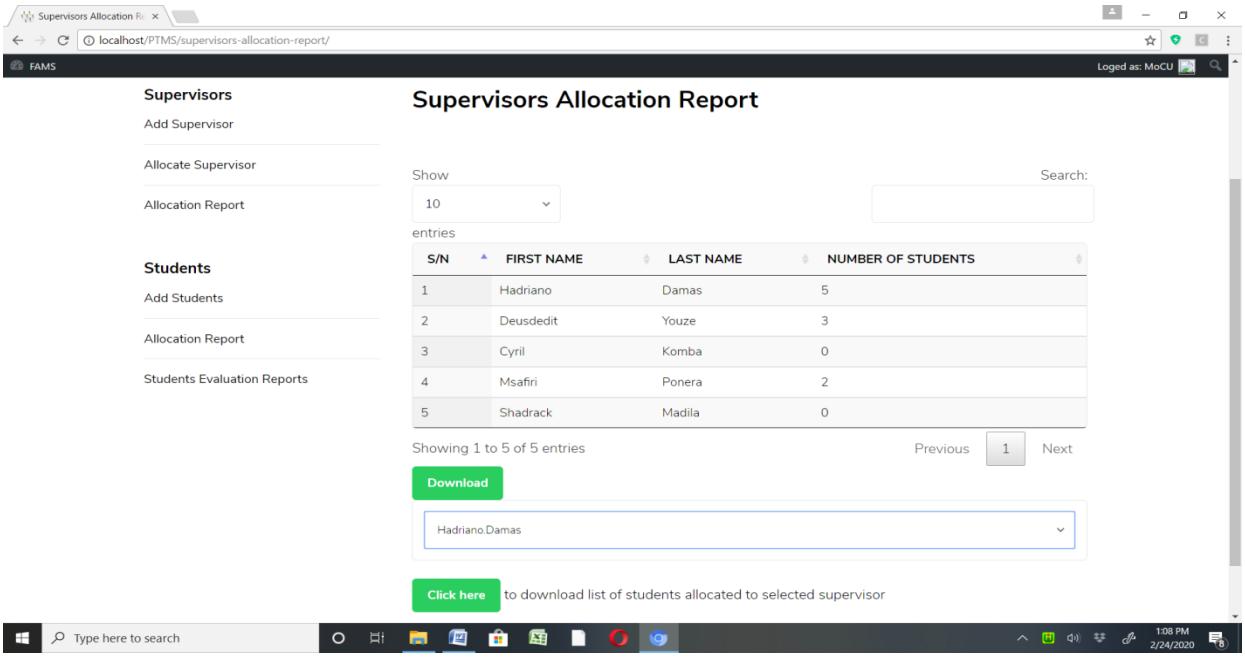


Figure 35: Downloading Options for Allocation Report

The overall success rate on test scenarios that were used to conduct the usability testing show that, most of the tasks were accomplished by 100% of test participants consistently. The summary of the success rate for each task scenario provided to test participants is as indicated in Table 12.

Table 12: Test Participants' Success Rates on Task Scenarios

Task	Users category	Total participants	Succeeded Participants	Success rate
Home page review	All	35	35	100%
Registration	Students	20	20	100%
Sending an application	Students	20	20	100%
Search by category	Students	20	20	100%
View application status	Students	20	20	100%
Reports submission	Students	20	16	80%
Adding eligible students	Coordinators	5	5	100%
Register new supervisors	Coordinators	5	5	100%
View allocation status	Coordinators	5	5	100%
Supervisors allocation	Coordinators	5	5	100%
Upload report templates	Coordinators	5	2	40%
View reports	Coordinators	5	3	60%
View allocated students	Supervisors	5	5	100%
View arrival declaration	Supervisors	5	3	60%
review students reports	Supervisors	5	5	100%
Student assessment	Supervisors	5	5	100%
Registration	Companies	5	5	100%
Post advertisement	Companies	5	5	100%
Advertise 2 field area	Companies	5	5	100%
Select students	Companies	5	5	100%
Students evaluation	Companies	5	2	40%

For tasks that test participants had low success rate as well as those which participants had shown to spend longer time to succeed were further analyzed to get reasons for bad performance. The improvement area section gives an analysis of the causes and solutions applied.

4.4.3 Improvement Areas for FAMS

(i) Reports submission instructions were missing

Students who participated in testing tried to upload files not compatible with the accepted format. The portal only shows download and upload options. A total of 4 participants who are

equivalent to 20% of participants did not succeed to submit reports. Only 2 out of 16 participants who succeeded to submit their reports spent less than 5 minutes. Moreover, most of the participants tried to repeat and fail without being asked what to correct by the system. They were displeased by not being able to figure out the reason for failure on their own. Although those who asked were able to complete a task, they had already spent longer than expected time due to missing submission instructions on a portal. Time spent by participants who succeeded to submit reports is as shown in Fig. 36.

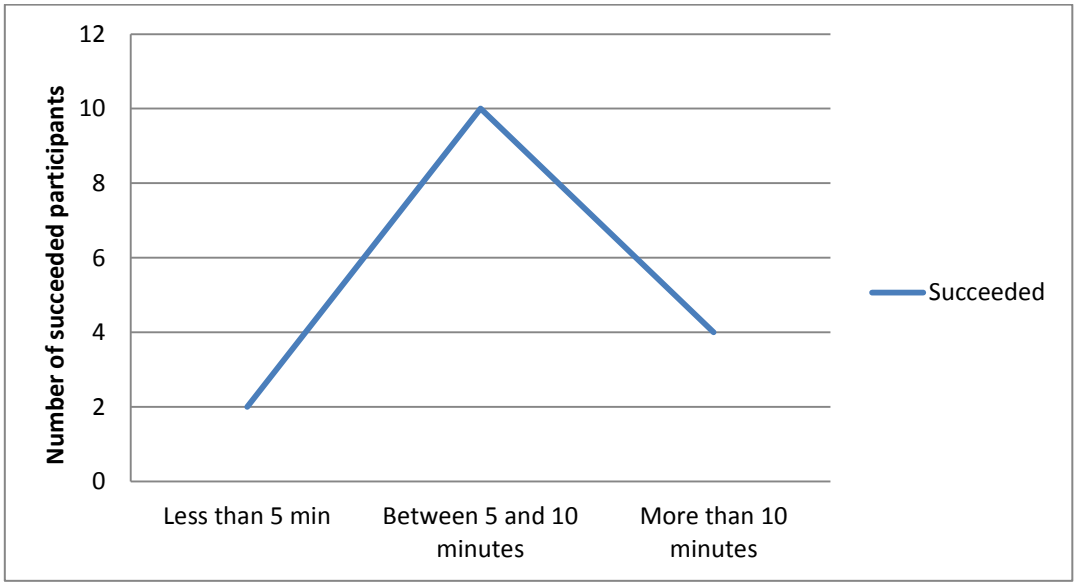


Figure 36: Time Used by Students who Succeeded to Submit Weekly Reports

For the side of companies, the effect of missing instructions for reports submission caused 3 participants to fail to upload students' assessment forms thus making a failure rate of 60%. Moreover, for the side of supervisors from HLIs, all participants succeeded to upload assessment forms but most of them spent more than 10 minutes. The success rate for companies to submit students' assessment forms is as indicated in Fig. 37.

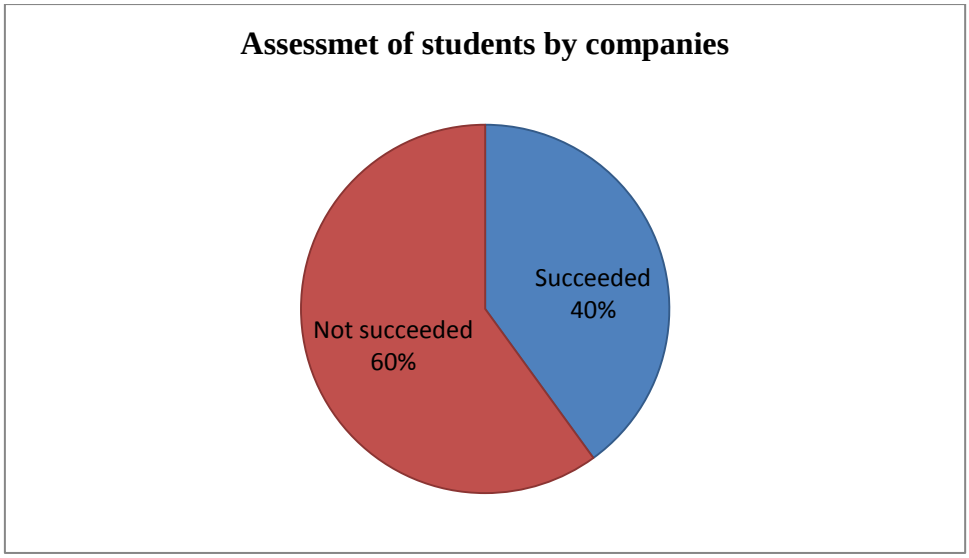


Figure 37: The Success Rate for Students' Assessment by Companies

The results show that supervisors could successfully conduct assessment of their allocated students after spending more than anticipated time as indicated in Fig. 38.

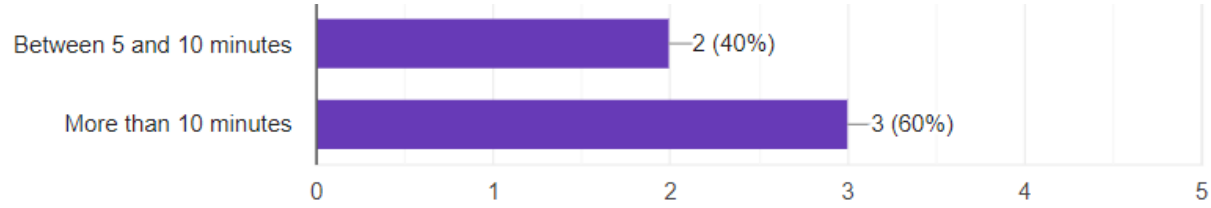


Figure 38: Time Spent for Students' Assessment by HLI

As an outcome of missing uploading instructions, results show that only 2 coordinators were able to upload reporting templates of their respective institutions. This is because, the system missed instruction on the format of files that can be uploaded as reporting templates for HLIs.

(ii) Allocation of more than one supervisor in one district was not possible

During testing, it was observed that there is a need for a system to allow allocation of more than one supervisor to a district with many students doing field attachment. This is not possible to be done with the developed system. The allocation can only be performed district-wise where one supervisor is automatically allocated to all students who are doing their field attachment in the allocated district. The solution to this observed challenge was to add a feature to allow allocation by specifying the maximum number of students who can be allocated to a supervisor.

4.4.4 Solutions Applied

The first observed challenge that led to the failure of test participant was caused by lack of proper instruction and clear error message to enable correction of inputs. The solution applied to resolve this challenge was additional of proper instruction on file formats that can successfully be uploaded as a reporting template. For students and companies to upload reports and evaluation forms respectively, the instruction which shows that a template has to be downloaded from the portal, filled and uploaded was added.

Supervisors' allocation challenge was because of a missing feature. This implies that the results of usability testing are important as they help to improve the system by identifying features that were overlooked during other stages of the Software Development Life Circle (SDLC).

4.5 Benefits to Stakeholders

FAMS is beneficial to both parties involved in students' field attachment. The benefits that FAMS offers to both field attachment stakeholders are as follows:

4.5.1 Benefits to Students

(i) Easy access to relevant companies

The system helps students to get information of companies which offer field attachment relative to their field of studies.

(ii) Easy feedback follow-up

Through the system, students can be able to send applications to companies and view status of their submitted applications.

(iii) No searching and application costs

The system gives students free access to search and apply for field attachment using their computers or smart phones.

(iv) Time saving process

The system reduces the processes involved in searching and applying for field attachment and therefore save time.

4.5.2 Benefits to Companies

(i) Saves applications processing time

Companies can receive electronic applications from students through the system. The electronic applications can easily be processed as compared to manual applications that are currently used.

(ii) No expenses in communicating feedbacks

Selection feedbacks can be communicated and reflected to specific students freely through the system.

(iii) Easy to find a right person

Companies can find the right person based on category of field attachment by relying on students' profiles registered in the system.

(iv) Reputation and recognition

Using the system can help to maintain good image of a company.

4.5.3 Benefits to HLIs

(i) Reliable allocation information base

Coordinators can always get both current and past allocation information that can be useful for policies making.

(ii) Saves documents processing time

FAMS reduces manual documents processing to coordinators. Through the system, students and companies can update the status of allocation documents that are reflected to the coordinator.

(iii) Reduce document handling costs

All the allocation documents can be stored in FAMS and thus the cost of handling manual documents can be reduced.

(iv) **Easy reports generation**

The portal enables coordinators and supervisors to generate different reports that are useful in managing field attachment.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This research study aimed at addressing the field attachment coordination and allocation challenges by developing an online system that facilitates the process by involving all stakeholders who are companies, students and HLIs. To determine the features of a portal, a mixed approach based on the Scrum framework was used to assess the current situation and find out what are the challenges and how to make some improvements.

In this study, all three stakeholders who are HLIs, students and companies were involved in the system's requirements determination. The stakeholders gave out their suggestions on what they will regard as a success after introducing a computer system to facilitate field attachment. Furthermore, related existing systems were studied and the features were analyzed to figure out whether they are enough to address existing allocation challenges. It was finally found that existing systems need some additional features befitting the current situation. The most suggested features were companies to be able to advertise available posts for field attachment, students to be able to register their profiles and make them available to companies and HLIs to be able to coordinate and supervise students during field attachment.

The study came out with a computer system for effective coordination and management of the field attachment. As compared to similar systems, the ability to make students' profiles available to companies and the fact that companies, students and HLIs can be registered and linked is what makes the developed system unique. The developed system was finally tested for usability and found to pass with a high degree of acceptance. Consequently, FAMS was confirmed to improve field attachment process by enabling quick access of information about companies to students, easy follow-up and reports generation and other value-added advantages like open doors for more collaboration between HLIs and companies.

5.2 Recommendations

Since the present findings has shown that there is no existing platform where companies information can be accessed by HLIs students and HLIs students profiles can be accessed by companies, it is recommended that HLIs should, therefore, start using the developed system.

This is because, the developed system has found to have addressed the current allocation challenges. To allow access of the system by all HLIs, the government through the responsible ministry or member-based institutions dealing with provision of services to HLIs like Tanzania Education and Research Network (TERNET) can adopt and host the system (FAMS). Furthermore, students, universities and companies can be given free access to the system and income can be generated through paid advertisements.

Since this study had only focused on field attachment, further research is recommended to include more value addition features like analysis of feedback from companies to get information that can be used by HLIs in regular curriculum reviews. Some other additional features like internship and job finding can also be further researched for allowing more collaboration between companies and HLIs since HLIs are responsible for producing expatriates to work in companies. It is also recommended that further research should be carried out on HLIs which bear the responsibility to find and allocate students to field attachment to see whether there are any different needs.

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APPENDICES

Appendix 1: Key Informant Interview Guide Questions

INTERVIEW GUIDE QUESTIONS

PART A: HLIs STUDENTS

1. What tool do you use for field attachment process? (Is there a system that supports this process today?)
2. What method do you use to apply for field attachment?
    a. Post office ☐
    b. Email ☐
    c. Online portal ☐
    d. Physical delivery ☐
3. How do you get company information?
    a. From friends ☐
    b. Company advertisement ☐
    c. Try and error (Apply without information) ☐
    d. Searching over the internet ☐
4. What are the biggest challenges in your role?
5. What problems are not being solved by your current system and what evidence do you have of this?
6. What does success look like?
7. What would happen if we don't change the way things are done today?
8. What key features do you want the new system to have?
9. Tell us about some of your reporting requirements. What would you really like to see produced as a report? Why?
10. Tell us how you would like to:
    (i) Search for Field Attachment placements (iii)Apply for Field Attachment
    (ii) Fill daily reports (iv)Report to supervisor

INTERVIEW GUIDE QUESTIONS

PART B: COORDINATORS (HLIs)

1. What tool do you use for field attachment process? (Is there a system that supports this process today?)
2. What are the biggest challenges in your role?
3. What problems are not being solved by your current system and what evidence do you have of this?
4. What does success look like?
5. Who do you think is impacted (positive and negative) by the new system and how?
6. What would happen if we don't change the way things are done today?
7. What other changes are happening within the organization that may impact this project?
8. What key features do you want the new system to have?
9. Tell us about some of your reporting requirements. What would you really like to see produced as a report? Why?
10. Tell us how you would like to:
    (i) Advertise/communicate available posts to your students
    (ii) Receive reports from students
    (iii) Receive reports from supervisors
    (iv) Register eligible students into the system

INTERVIEW GUIDE QUESTIONS

PART C: FIELD ATTACHMENT HOSTS (COMPANIES)

1. What tool do you use for field attachment process? (Is there a system that supports this process today?)
2. What are the biggest challenges in your role?
3. What problems are not being solved by your current system and what evidence do you have of this?
4. What does success look like?
5. Who do you think is impacted (positive and negative) by the new system and how?
6. What would happen if we don't change the way things are done today?
7. What other changes are happening within the organization that may impact this project?
8. What key features do you want the new system to have?
9. Tell us about some of your reporting requirements. What would you really like to see produced as a report? Why?
10. Tell us how you would like to:
    (i) Advertise available posts
    (ii) Receive applications
    (iii) Report feedback to applicants
    (iv) Fill and communicate students reports

Appendix 2: Collaborative Prototype Testing Scenarios

FAMS Prototype Testing

1. HLIs Students

   Login into the system using login (student)link at top right corner, look for new company's profile and send an application.

   (i) Do you get all information you need?

   (ii) Which functionality was difficult to find?

   (iii) Was there any content or information that was not clear?

   (iv) What would you like to see differently?

   (v) What features are missing?

2. Coordinators (HLIs)

   Login into the system using login (coordinator)link at top right corner; then,

   - Add, allocate and view allocation report for supervisors you have allocated.
   - Add students list into the system and view students' reports.

   (i) Do you get all information you need?

   (ii) Which functionality was difficult to find?

   (iii) Was there any content or information that was not clear?

   (iv) What would you like to see differently?

   (v) What features are missing?

3. Companies

   Register your company into the system using Company looking for students (advertise post) link then advertise new posts for students.

   (i) Do you get all information you need?

   (ii) Which functionality was difficult to find?

   (iii) Was there any content or information that was not clear?

   (iv) What would you like to see differently?

   (v) What features are missing?

Appendix 3: Usability Test Plan

USABILITY TEST PLAN

FOR: Field Attachment Management System (FAMS)

SCOPE

This test plan will be used to evaluate a portal for coordination of students' field attachment. The usability test will cover the navigation and contents of the system. Companies/organizations, students, supervisors and coordinators from universities will be involved in testing system according to their respective roles.

The test objectives of this usability study are to evaluate the portal relative to user's ability to:

Student

- Register into the system
- Search for relevant companies and apply for field practices
- Fill and upload different reports

Coordinator

- Add and allocate supervisors through the system
- Upload different forms required to be filled by students and supervisors
- Generate allocation reports for students and supervisors

Supervisor

- View assigned activities
- Conduct student assessment

Companies

- Register into the system and
- advertise available posts for field attachment
- Go through received application documents and make selection decision
- Evaluate students' performance and post feedback to the university

PURPOSE

The purpose of conducting this test is to come up with the answer on the following portals' usability questions:

- Can user complete his goal?
- How fast can user complete a task by using a portal?

- Can user do it correctly?
- Can user easily get help he might need?
- Can user perform the task correctly the first time?
- Is the user happy with the system?

SCHEDULE & LOCATION

The test will be conducted from end of June 2019. Students and supervisors will be invited in computer laboratory at Moshi Co-operative University (MoCU) in Moshi. Coordinators and respondents from companies will be followed at their working area. The test schedule is as indicated in table 1.

Table 1: Test schedule

Pilot Testing Date June 28th, 2019	
10:00AM – 11:00AM	Pilot user
Testing date: July 1st to July 4th ,2019 (Students) – Total 20 participants	
8:00AM – 9:00AM	Preparation and setup
9:00AM – 10: 00AM	Participant # 1
10:30AM – 11:30AM	Participant # 2
12:00NOON – 01:00PM	Participant # 3
01:00PM – 02:30PM	Break
02:30PM – 03:30PM	Participant # 4
04:00PM – 05:00PM	Participant # 5
Testing date: July 5th ,2019 (5 Supervisors)	
8:00AM – 9:00AM	Preparation and setup
9:00AM – 10: 00AM	Participant # 1
10:30AM – 11:30AM	Participant # 2
12:00NOON – 01:00PM	Participant # 3
01:00PM – 02:30PM	Break
02:30PM – 03:30PM	Participant # 4
04:00PM – 05:00PM	Participant # 5

Testing date: 8th July , 2019 - Moshi (2 coordinators)	
9:00AM – 10:00AM	Participant # 1
02:00PM – 03:00PM	Participant # 2
Testing date: 9th July , 2019 - Moshi (2 companies/organizations)	
9:00AM – 10:00AM	Participant # 1
02:00PM – 03:00PM	Participant # 2
Testing date: 11th July , 2019 - Arusha (2 coordinators)	
9:00AM – 10:00AM	Participant # 1
02:00PM – 03:00PM	Participant # 2
Testing date: 12th July , 2019 - Arusha (2 companies)	
9:00AM – 10:00AM	Participant # 1
02:00PM – 03:00PM	Participant # 2

SESSION

Each test session will take one hour that will include:

(i) Test introduction and pre-test questionnaire (15 minutes)

(ii) Task scenarios including post-task questions after each scenario (35 minutes)

(iii)Post-test questionnaire (10 minutes)

EQUIPMENT

The following equipment will be used in a test session:

- Laptop which users will be using to access the portal
- Eye tracking device that will be used to record user's concentration area.
- Sound recorder for recording user's thoughts when they think out loud

PARTICIPANTS

The portal will be tested by a total of thirty (33) users. The screener that will be used to select participants is in appendix 1. Users will be selected based on characteristics distribution for each group as indicated in table 2.

Table 2: Participants selection criteria

Group	Characteristics	No. of participant	Total
Students	**Gender**		**20**
	Male	10	
	Female	10	
	Have done any application through a portal		
	Yes	15	
	No	5	
	Have once attended field attachment		
	Yes	10	
	No	10	
Coordinators	**Time worked as coordinator**		**4**
	1-3 years	2	
	More than 3 years	2	
	Presence of a computer system to facilitate		
	Yes	2	
	No	2	
Supervisor	**Time in supervision**		**5**
	1 – 3 years	2	
	More than 3 years	3	
	Presence of a computer system to support		
	Yes	2	
	No	3	
Companies	**Number of years have been receiving students**		**4**
	Less than 1 year	1	
	1 – 3 years	1	
	More than 3 years	2	
	Average number of students received per year		
	1 – 5 students	1	
	6 – 10 students	1	
	More than 10 students	2	
	How they advertise available posts		
	Submit to university	1	
	Through website	1	
	Don’t advertise	2	

	How they receive applications		
	Computer system	1	
	Other systems	3	

SCENARIOS

To meet the test objectives, participants will be required to complete a task by being introduced to number of scenarios. The task scenarios for each group of users are as described in table 3.

Table 3: Task scenarios

Scenario	Task	Estimated Time (Min)
A: STUDENTS		
Open the portal. What can you do here?	Home page review	4
Register into a system and complete your profile documents	Register Complete profile	4
Apply to one company	Sending an application	5
Find a list of companies which accept more than 3 Accounting students.	Search by category Filter by companies ability	4
Make follow-up of your application and confirm to go for one of the companies that accepted you	Application status and confirmation	4
Submit a report for the first week at the field	Reports submission	4
B: COORDINATORS		
Open the portal. What can you do here?	Home page review	4
Register list of students	Add eligible students for academic year.	2
Register 5 supervisors	Register new supervisors	2
Check allocation status of students	View students' allocation statu	4
Allocate 2 supervisors to students who are in Moshi and Arusha regions respectively.	Supervisor allocation	5
Make your reporting requirements available to all who are require to fill them	Upload report templates	4
You want to view students and supervisors reports	View reports	4
C: SUPERVISORS		
Open the portal. What can you do here?	Home page review	5

View all students that you are going to supervise	Login View allocated students	5
Make follow up to see students who have arrived to companies for field attachment	View arrival declaration	5
Comment on students weekly reports	Assess students reports	5
Fill assessment forms for two students	Student assessment	5
D: COMPANIES		
Open the portal. What can you do here?	Home page review	4
Register into the system	Register	4
Advertise 5 posts for accounting students to your company.	Login Post advertisement	5
Your company has branches in different regions; Post advertisements for Moshi and Arusha branches. Each branch can accommodate 4 IT students and 2 accounts students	Advertise more than one category in one company	4
View applications that you have received and make selection	Select students	4
Evaluate 2 students who have completed their field practices	Students evaluation	4

METRICS

The test evaluation will be done by using the following satisfaction metrics:

- pre-test questionnaire – to understand type of the user who is doing a test
- post-task questionnaire – to get users' opinions regarding a task
- post-test questionnaire – for entire system usability metrics

Other metrics that will be measured are, time on task, success rate, and error rate. These data will be recorded during the session.

Qualitative data will also be evaluated and reported. Qualitative data that will be recorded during test session include comments, questions and verbal from thinking out loud. Pre-test, post-task and post-test questionnaires are as in attachments 3, 4 and 5 respectively

ROLES

Moderator will be responsible for:

- Setting the room and equipment
- Go through session opening script and ask pre-test questions
- Introduce task scenarios and ask post-task questions

- Observe and record both quantitative and qualitative metrics, respond to questions and comments during the session
- Administer post-test questionnaire and end the session

ATTACHMENT 1: USERS SCREENER

Part 1: Students

1. Are you willing to be recorded during the session?
   [ ] Yes (Continue) [ ] No (Terminate)
2. Sex
   [ ]Male [ ] Female
3. Have you ever send any job application through an online portal?
   [ ] Yes [ ] No
4. Have you ever gone for field practice?
   [ ] Yes [ ] No
5. Which platform did you use to apply for field attachment?
   [ ] Computer system [ ] Email [ ] Post office [ ] Go physically
   [ ] Others (please specify)
6. How did you know about availability of field practice posts in a company?
   [ ] I was just trying [ ] Advertised through website
   [ ] Recommended by a friend

Part 2: Coordinators

1. Are you willing to be recorded during the session?
   [ ] Yes [ ] No (Terminate)
   (Continue)
2. For how long have you worked as a coordinator?
   [ ] Less than 1 year [ ] 1-3 years [ ] More than 3 years (terminate)
3. Are you using any system to facilitate the coordination?
   [ ] Yes (Please brief the system functionality) [ ] No

Part 3: Supervisors

1. Are you willing to be recorded during the session?
   [ ] Yes [ ] No (Terminate)
   (Continue)
2. For how long have you supervised students?
   [ ] Less than 1 year [ ] 1-3 years [ ] More than 3 years (terminate)
3. Are you using any system to facilitate your supervision duties?

[ ] Yes (Please brief the system functionality) [ ] No

Part 4: Companies

1. Are you willing to be recorded during the session?
   [ ] Yes (Continue) [ ] No (Terminate)
2. For how long is your organization receiving students for field attachment?
   [ ] Less than 1 year [ ] 1-3 years [ ] More than 3 years
3. How many students do you host each year?
   [ ] 1-5 students [ ] 5-10 students [ ] More than 10 students
4. How do you advertise available posts to host students?
   [ ] Submit to universities [ ] Through our website [ ] We don't advertise
5. How do you receive applications from students?
   [ ] Computer system [ ] Email [ ] Post office
   [ ] They submit physically [ ] Others (please specify)

ATTACHMENT 2: SESSION OPENING SCRIPT

Hello, Fellows. My name is Erick, and I am going to moderate this session. How is your day going?

Thank you for your valuable time to participate in this session, and no doubt you will find this experience interesting.
Well, what we are going to do is a usability testing on a portal for field attachment management and coordination. We want to get your impressions of this portal and don't worry about making mistakes because, what we are going to test is not your ability to use the portal but rather we are testing the portal. We are interested in knowing how you do things, how you react to things and what you are thinking regarding different parts of the portal. We are going to test the portal by asking you to complete a series of tasks that you have to complete when you are using the portal to achieve your goal.

When you are completing a series of tasks in a portal, you may get confused, frustrated or be happy with how it works. We need to know these feelings too so we can come up with necessary improvement suggestions. We are asking you to share with us what you think of your experience with the portal by thinking out loud whether is positive or negative.

We are going to watch you completing these task scenarios, take some notes and ask you few questions about your opinions after a task. The information will only be used to prepare findings report.
I would like to know if you have any questions or concerns before we begin.

ATTACHMENT 3: PRE-TEST QUESTIONNAIRE

1. What is your experience using a computer?
    a. Less than a year
    b. 1 – 2 years
    c. More than 2 years
2. Frequency of using a computer
    a. Daily
    b. Monthly
    c. Never
3. How many hours do you spend using a web in a day?
    a. Less than 1 hour
    b. 1 – 2 hours
    c. 2 – 4 hours
    d. More than 4 hours
4. Which device do you normally use to open web sites?
    a. Mobile phone
    b. Laptop
    c. Desktop computer
5. Which sites do you normally like to visit?
6. What features do you like about them?
7. Have you ever applied for anything using online portal?
8. What was your experience using that application portal?

ATTACHMENT 4: POST-TASK QUESTIONNAIRE

1. I think it was…….to complete this task
    a. Very difficult
    b. Difficult
    c. Somewhat easy
    d. Very easy
2. The task could be made easier by ……..
3. How did you find the language used?
    a. Easy to understand
    b. Not easy to understand
    c. Confusing
4. How did you find the layout of the contents?