# Design and Implementation of a Web-Based Internship Placement Recommendation System: A Case Study of Federal Polytechnic, Ile-Oluji, Nigeria.

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**Abstract**
Every year, thousands of graduates of Nigeria's tertiary institutions are being role out into the labor market, a greater percentage of these graduates are not employable, because they lacked the relevant and requisite skills required to function in the industries, this is due to the noticeable gap between the theoretical teaching and industry practices. An internship provides a platform for students to acquire skills required in the industries. It exposes the student to industries' work situations, skills, and experience in handling machinery and equipment used in the workplace. Many students are unable to find a suitable and relevant placement that will add to their skills level and experience. This paper reports a work that developed a robust, flexible, and web-based hybrid recommendation system for Federal polytechnic, ile Oluji, it combines content-based filtering (CBF), collaborative filtering (CF), and knowledge-based filtering (KBF) methods to recommend relevant internship organizations that meet student's aspiration and enhance their skills. The dataset used for the development of the system was obtained from the SIWES unit of the institution and the SIWES office in Akure. In addition to the previous companies uploaded, the system allows an organization that needed students on an internship to register and upload their profile into the system. The system allowed students to make multiple applications to recommended organizations based on their course of study and areas of expertise. The system is highly scalable, easy to use, understand and respond quickly to users' requests.



**Keywords**: Filtering, recommendation system, skills, internship, SIWES, Industrial Training

## Introduction

The existence of a gap between theoretical teaching and industry practices poses a great threat to the production of an experienced workforce, According to Adekola et al., the lack of competence of many job seekers is one of the factors that is responsible for the high rate of unemployment in Nigeria [1]. Internships, in the form of industrial training (IT), industrial attachment, teaching practice (TP), Students' Industrial Work Experience Scheme (SIWES) are some of the programs put in place by the Nigerian government to bridge the wide gap between student's competence and industries workforce requirement. Industrial training has been identified as a vehicle for industrial advancement and human capital development. It allows meticulous job role performance and production experience, competent and effective employee [2]). The internship provides the integration of theoretical learning and skill acquisition, it impacts the performance of the interns positively [2]. Internship prepares and exposes students of higher institutions of learning and technical colleges to the industry work situation that they face after their graduation, it transits students from the institution environment into the real world work environment. It exposes the student to needed experience in handling tools, machinery, and equipment that are usually not available in their institution. In addition, the internship will also afford the student to develop skills in work ethics, workplace communication skills, and job acumen. Bukaliya [3] opined that students acquire essential skills and knowledge through the internship program.

Despite the benefits offers by internships, so many students are unable to find suitable and relevant placements based on their locations, preference, course of study, and area of specialization. Edet Identified institutional sourcing, individual student sourcing, and employer request as the three sources of internship placement [4]. While employer requests are rarely common nowadays, the students spent a huge amount of time seeking a good and relevant placement without any success. Most of the placement sourced by the institution is too vague and does not have direct relevance to the students' expected area of interest. Locating the relevant organization for the internship is vital to the actualization of the benefits of the internship. Securing a beneficial place for an internship will have a substantial impact on the student's professional advancement.

Manual search for places of an internship is not exhaustive and highly frustrating and most of the time leads so many students to settle for placement with minimal or even no relevant training, experience, and industrial exposure at all, coupled with accessibility and financial challenges to access the location of the internship, the problems of manual search for internship placement motivated this research, which aimed to provide an information communication technology (ICT) solution that will carry out an exhaustive electronic search for internship placement based on student's locations, course of study, area of specialization, and preference among the recommended organizations for internship.

Recommendation systems (RS) are software filtering systems with the ability to make relevant suggested outcomes based on users' preferences or, and previous users' ratings to optimize the quality of decision making in the domain of its application. The application of a recommendation system in the domain of internship placement will eradicate the problems of manual search for places for an internship. The following type of filtering has been used in recommendation system; Content-based filtering (CBF) [5], Collaborative filtering (CF) [6], knowledge-based filtering (KBF) [7], and hybrid filtering (HF) [8]. CBF makes the recommendation for a user based on the similarities (background information) that exists between the user's profile and the already stored user's profile, its predictions ignore contributions from other users. CF technique is the most mature and the most commonly implemented RS. It recommends items by identifying other users with similar tastes; it uses their opinion to recommend items to the active user. CF techniques match content resources to user characteristics, it compute certain metrics such as correlation, distance to understand the similarity between users and outcomes. It makes use of previous users' ratings to make a recommendation. KBF uses preference information provided by the users to make a recommendation, it is the simplest type of RS to implement. The Hybrid RS combines any two or the whole three filtering techniques in such a way that harnesses their strengths, increases the accuracy and performance of the RS while minimizing their corresponding weaknesses [9].



**Literature review**

A study on the effect of internship on student performance carried out by Ali and Smith reported a positive impact on student performance [10]. Authors in [11], listed the merits and demerits of various approaches employed in recruitment recommendation systems. Orimoloye and Kolawole developed a mobile-based SIWES placement recommendation system for Adekunle Ajasin University, Akungba Akoko, data supplied by the SIWES unit of the university was used to evaluate the system, the report did not mention the filtering technique implemented in the work [12]. JobFinder, a collaborative filtering recommendation system developed by [13], matches the profile of a job applicant to the profile of a similar user to filter recommended jobs for applicants. Most web-based recommendation systems are based on CF and CBF [14]. Cai et al. applied machine learning techniques to develop a CF recommendation system that predicts applicants that matches the features of employers to the applicant's

qualification [15]. The job recommendation system developed by [16] recruits students by matching their profile to the company profile. Desai et al. developed an online job hunting recommendation system for graduate and post-graduate students based on user-based and item-based CF methods, from the study, the item-based CF method performs better than the user-based method [17].

The limitations of the manual search for places of internship motivated this work, it proposed the development of a hybrid recommendation system that combines KBF, CF, and KBS filtering methods to suggest relevant internship organizations that match student's aspirations, similar users outcome, and previous users rating, it allows students to select the prefer organization from it suggested organizations, based on their proximity, cost of getting to the location for the placement from their residences, and other user's preference.

**System Analysis and Design**

The system analysis and design were carefully carried out systematically, the existing manual search methods were analyzed and its limitation was identified, the design improved on these limitations. Extreme programming (XP), a form of agile software development was adopted for the development of the Internship placement recommendation system, relevant information concerning the two major users of the system; authorized students of the institution, and the list of organizations that had previously accepted students for internship, were obtained from the SIWES unit of the institution and the Industrial Training Fund (ITF) zonal office in Akure. The design of the interface was carried out, followed by the coding of the system, the acceptance test for the system was thoroughly carried out by a team of the developers, staff of the SIWES unit, and some selected students. The functional requirement of the RS allows companies to register on their own or be registered by the system administrator, student information was uploaded by the system administrator. The system recommends internship (SIWES) placement to the student also known as an applicant. The system was designed with access control functionality that allows it to differential the three user categories and apply the appropriate role to each of them. The following are the nonfunctional requirement of the design;

a) **User friendly:** The system is easy to use and understand.
b) **Performance:** The system responds quickly to user requests.
c) **Maintainability:** The system is easy to maintain as any changes to it can be implemented easily

Figure 1 depicts the system architecture of the proposed recommendation system.

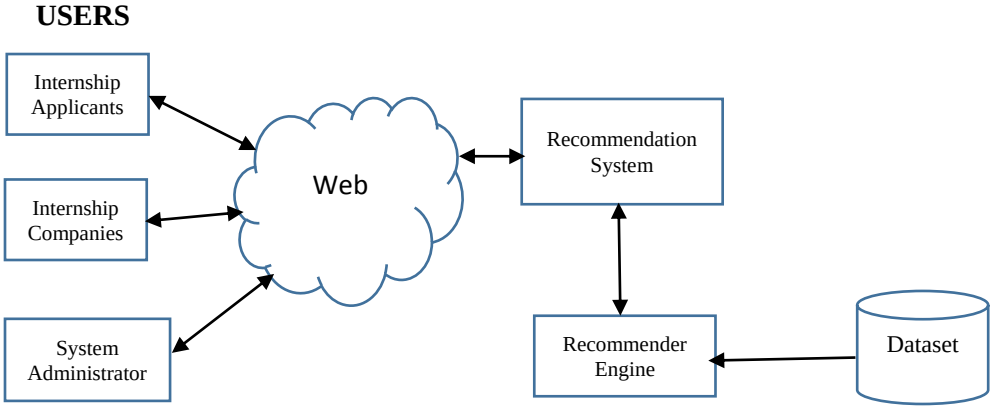


*Figure 1: Architecture of the Internship Placement Recommendation System*

The system interacts with its various users via the web to perform the following functions;

a) Provide a platform for applicants to apply for the internship based on their course of study, area of expected expertise, and local government areas where they intended to have the internship
b) Allow applicants to apply to one or more of the recommended companies
c) Notify companies about applicant's pending applications
d) Notify the applicant about his application's status in the companies
e) Convey the list of companies ready to accept an applicant for the internship to the applicants
f) Allow the applicant to select only one company among the companies that have accepted to sign them on based on their preferences.
g) Once an applicant assumed duty in a company, such applicant is disabled from making any other application, and information about the current status of the applicants are sent to other companies willing to sign the applicants on
h) Allow the applicant to rate experience acquired on monthly basis and overall at the end of the internship
i) Stores applicant's and company data to the dataset

The Recommendation system relies on its recommender engine to analyze the dataset based on applicants' inputs and its filtering algorithms to make relevant internship placement recommendations. The dataset contains three categories of data;

(i) Background data, these are information that the system has before the recommendation process begins. It includes data on the organizations with their locations and areas of specialization, this data was obtained from the SIWES unit of the institutions, from the previous Industrial internships program.
(ii) input data, this are the information that users must communicate to the system to generate recommendations,
(iii) Acquired Data, these are knowledge gathered from the mapping of the background data and inputted data. These include users' monitored behavioral patterns, rules, and heuristics

The roles of each of the users of the recommendation system are spelled out in the case diagram (figure 2). The diagram shows the functionality of the developed system, together with the associated user that can perform particular roles.

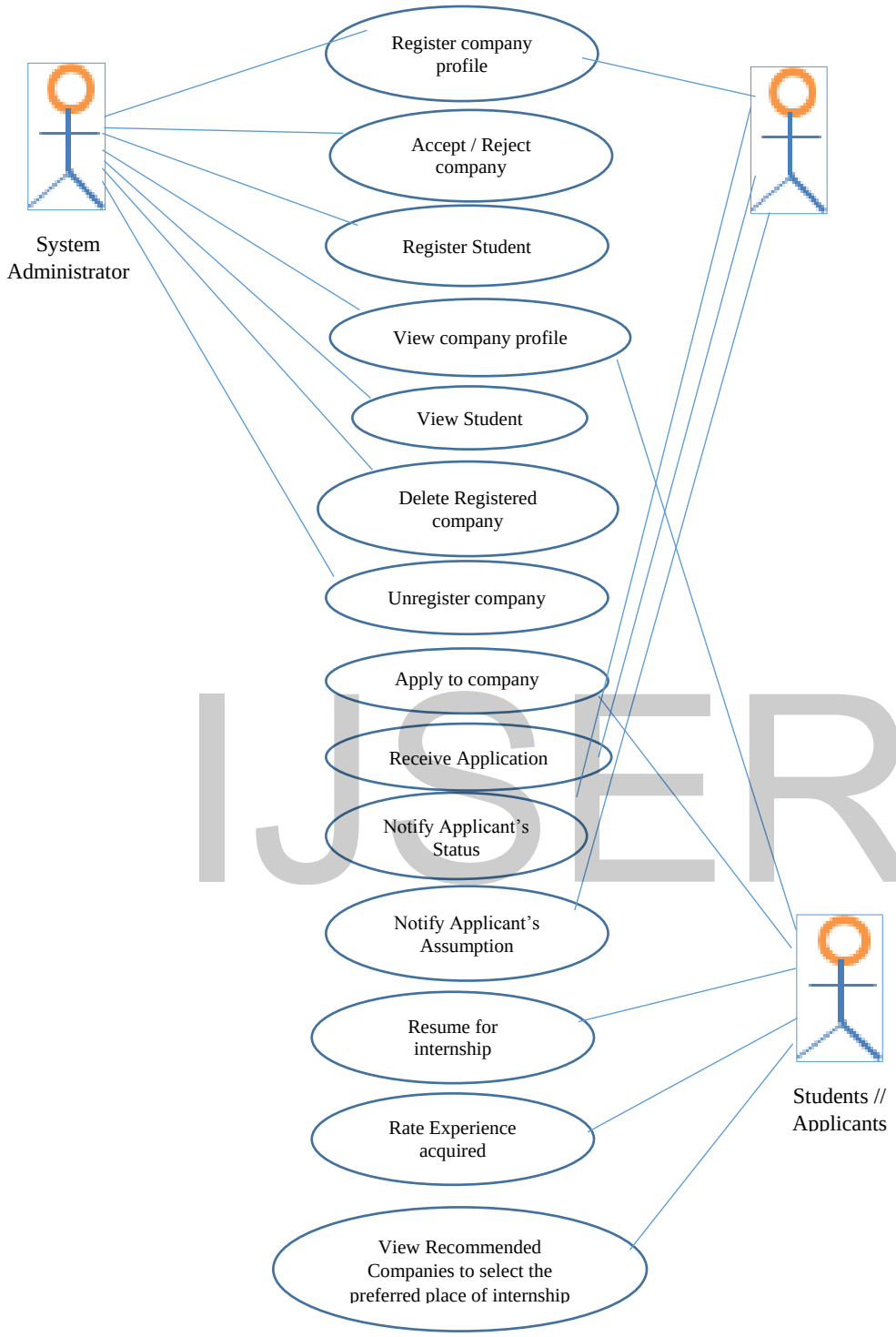




Figure 2: Case Diagram of all user's Role

**System Implementation**

The system was implemented using C# for the backend, hypertext markup language (HTML), CSS, and JavaScript on the SQL server. Figure 3 shows the central login page, it enforced access control to the system through authentication via the user's name and password. Users can log in authenticated as a student, a company, or an admin. Each access level and its operations are only visible only to the level. The Admin dashboard in figure four is the summary page, it displays the number of companies whose applications have been approved and that are pending. It also shows the number of students on the system and their internship status

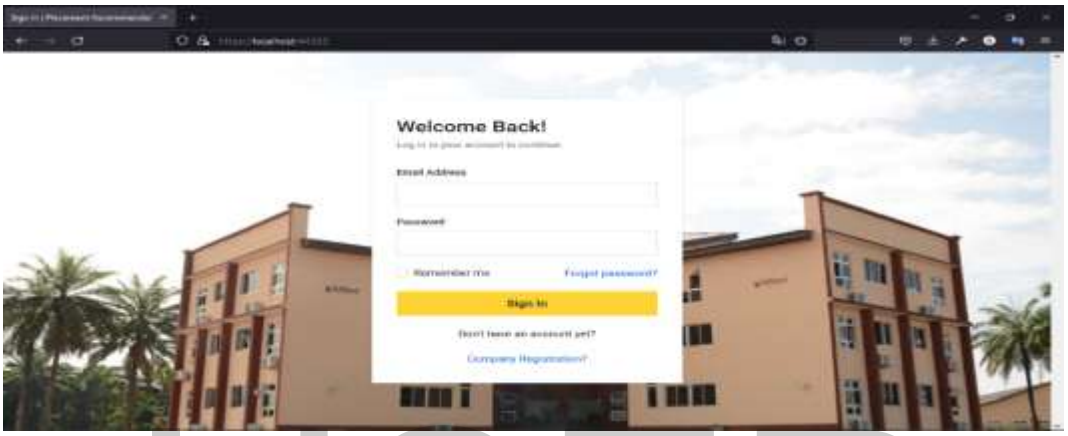


Fig 3: Central Login /Authentication Page

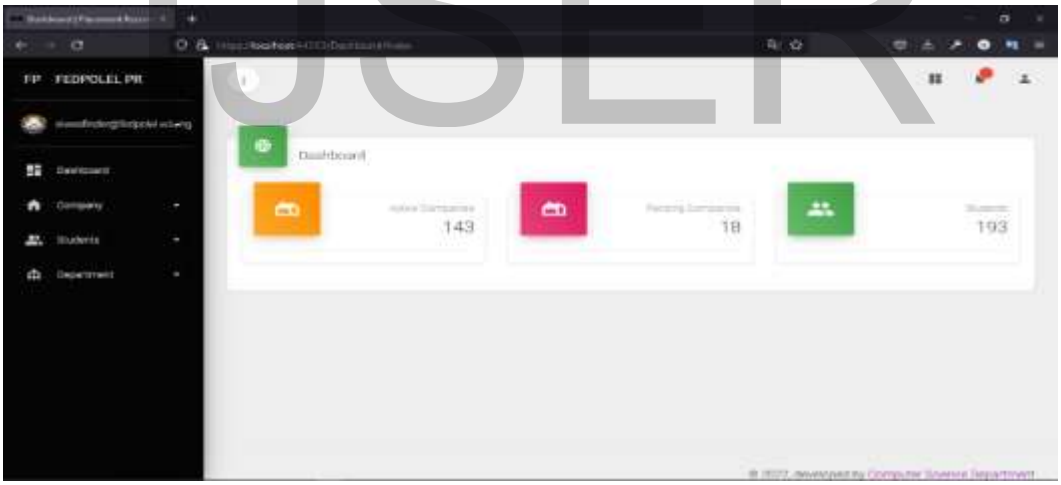


Fig 4: Admin Dashboard

The Screenshot of web pages in figures five and six handles the registration of the internship companies, interested companies can register their companies on the page in figure five. The system admin can also register companies that had previously accepted students for internships or new companies that indicated interest to accept students for internships into the system as shown in figure six, this page is restricted to admin only. The company's address/location, areas of expertise, the preferred duration for an internship; ( 3, 4, 6, or 12 months), its ability to pay or not pay for internship students, working days of the week, and hours are some of the information required to be submitted and uploaded for the company's registration. A company profile is depicted in figure seven, it shows detailed information about a company. Admin and

company representatives can view a company's profile. Students can view only the profile of recommended companies.

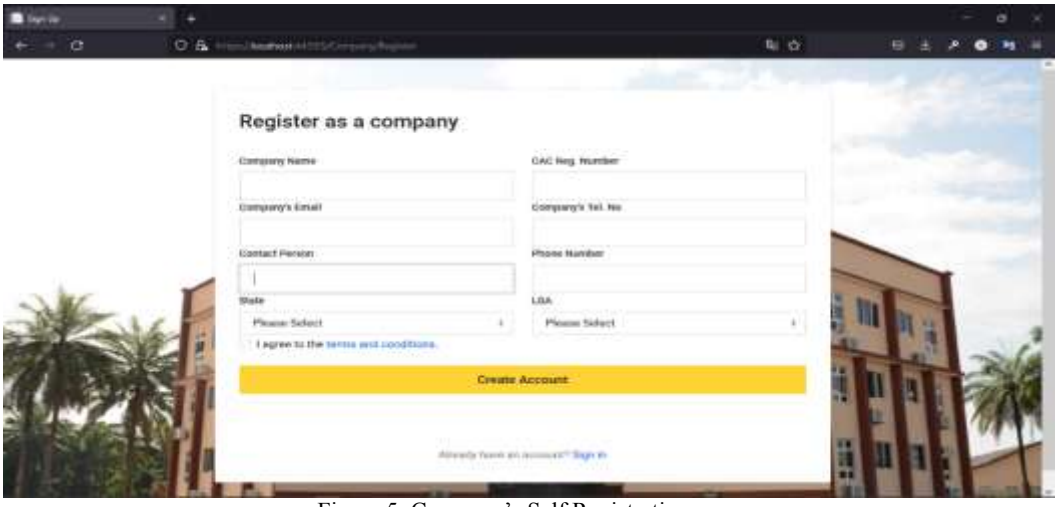

Figure 5: Company's Self Registration page

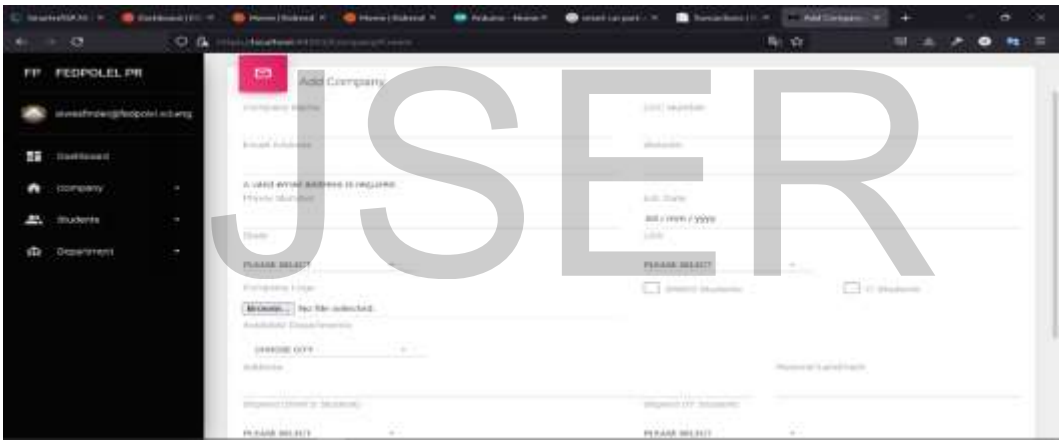

Figure 6: Admin Registration of Company's page

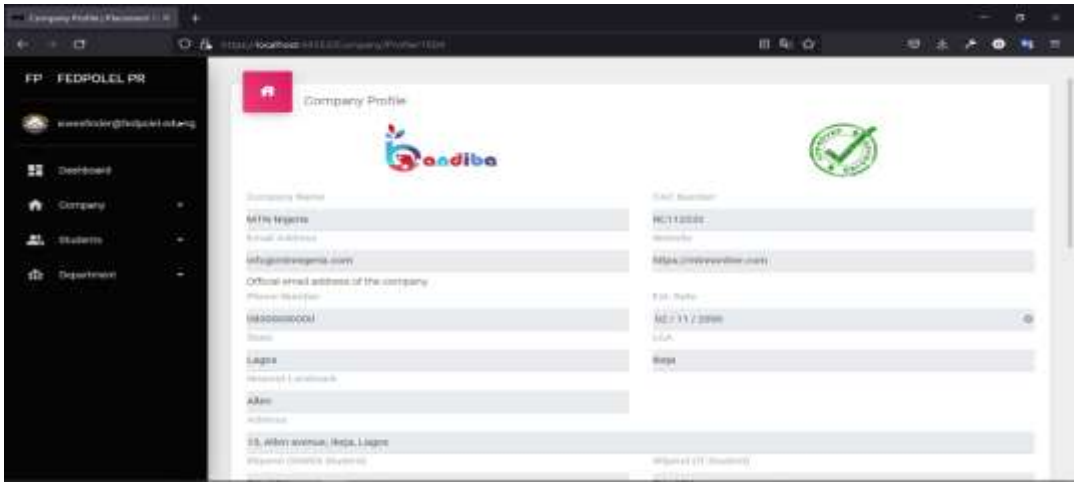

Figure 7: Company's Profile page

The student profile is shown in figure eight, The page in figure nine depict the student application page on the recommendation system, the student queried the system based on the following criteria; course of study, area of interest within the course of study, preferred state and local government area for the internship as shown in figure nine. The recommendation system then used its Recommender Engine to display recommended companies to the student in figure ten based on the inputs of the student

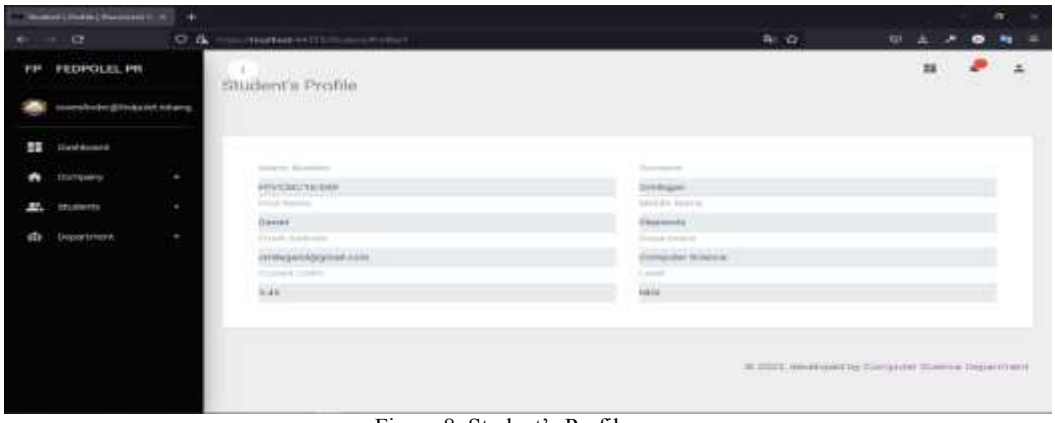


Figure 8: Student's Profile page

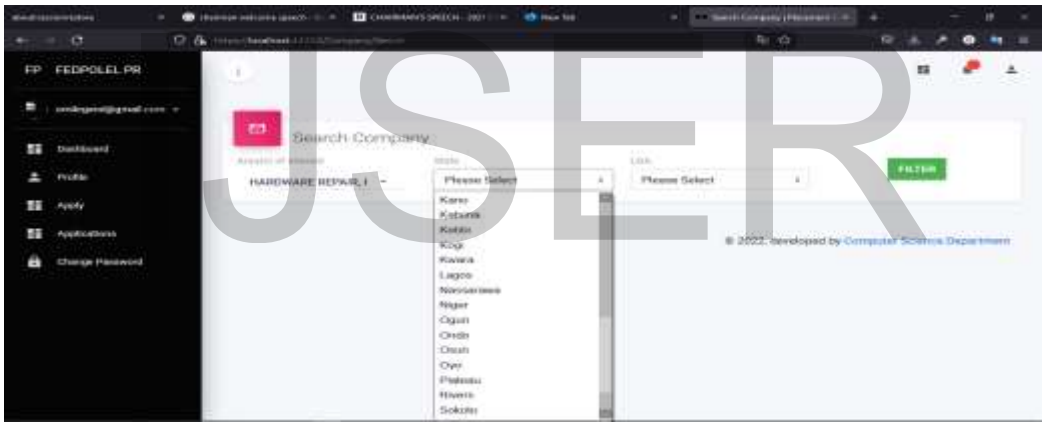


Figure 9: Student's Application page

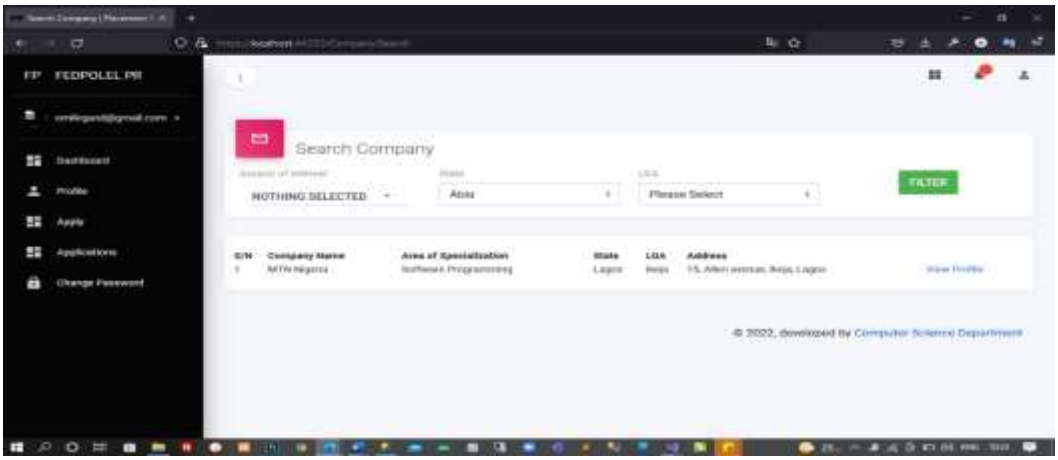


Figure 10: Company's Profile page

The student can then view the profile of the recommended companies to apply for the internship, student can make multiple applications from the list by clicking on the view button as shown in figure eleven to apply. The company will be notified by mail when there is a new application from any student see figure twelve. Figure thirteen shows the application status of the students, which could be pending, approved, or not approved, pending indicated that a decision has not been made on the application, approved indicated the student's application has been considered for an internship while not approved indicated that application is not successful.

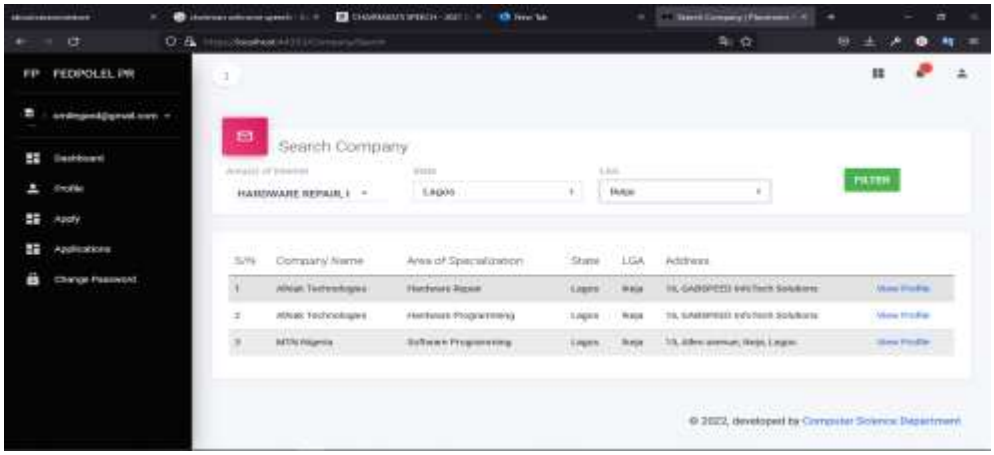


Figure 11: List of recommended companies for internship page

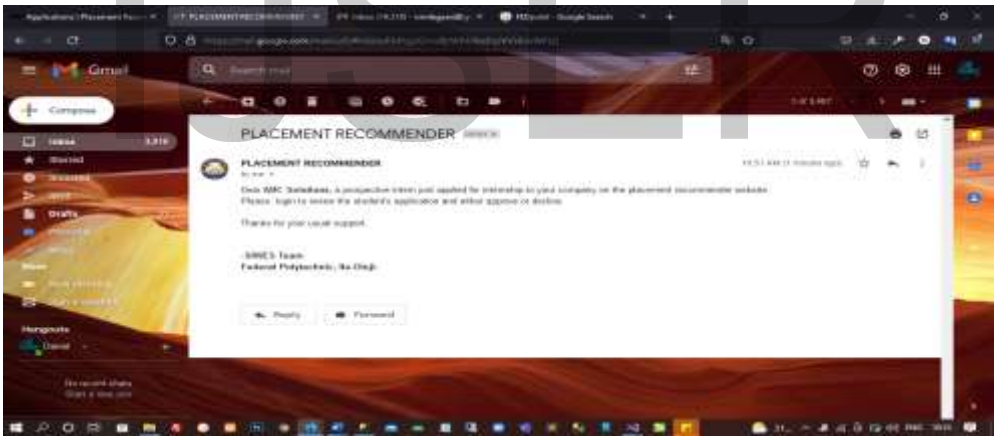


Figure 12: Notification of Student Application page

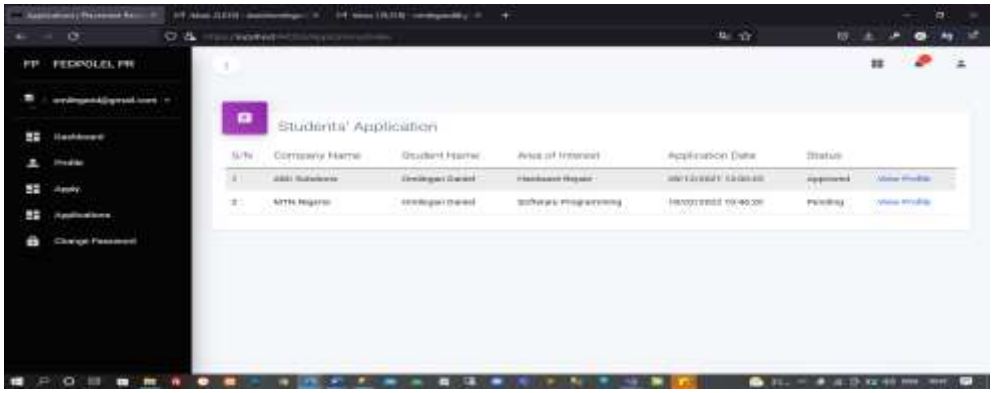


Figure 13: Student's Application Status page

The student is at liberty to resume at any of the companies that had approved his application, once a student resumed (figure fourteen) at any of the approved companies, the student cannot apply for internship placement again, the student will be restricted from further applying to other companies and as well as make the students unavailable to all other companies he has previously applied, as shown in figure fifteen.

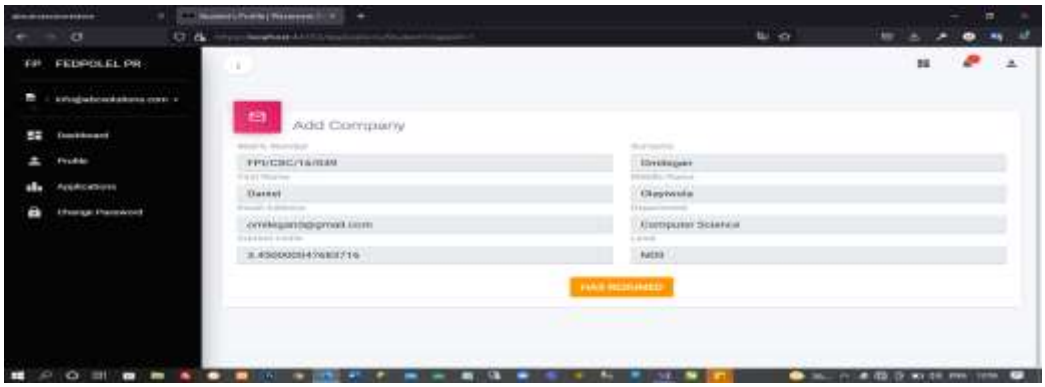


Figure 14: Student's Application Status page

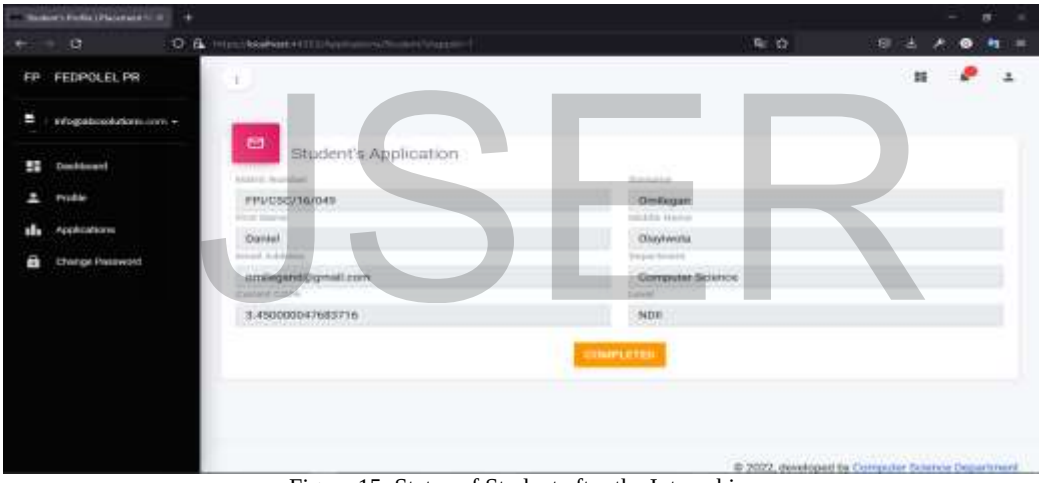


Figure 15: Status of Student after the Internship.



## Conclusion

The use of manual search for placement internship is not exhaustive, highly frustrating and most of the time leads so many students to settle for no placement or placement with minimal or even no relevant training, experience, and industrial exposure at all, coupled with accessibility and financial challenges to access the location of the internship. This work provides an information communication technology (ICT) to solve the problem of manual search for internship placement, it developed a hybrid filtering recommendation system. The system filters from past internship records and previous students' internship ratings to recommend suitable and relevant internship organizations to the students based on their locations, course of study, and areas of specialization. The students can apply to any of the recommended companies, with the liberty to select only one of the companies that give their application favorable consideration. Relevant information and data concerning the two major users of the system; authorized student of the institution and the list of organizations that had previously accepted students for internships used for the system development were obtained from the SIWES unit of the institution and the Industrial

Training Fund (ITF) zonal office in Akure. Scalability and access control functionality was built into the system, the system is easy to use and responded to users' action quickly.

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