

Development Of Progressive Web App-Based Workflow Management System For Human Resource Processes In Tertiary Institutions

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Abstract— This paper presents the development of a Progressive Web App-based workflow management system for human resource processes in tertiary institutions, using University of Uyo as case study. The system aims at integrate a systematic workflow management mechanism based on the specific user and system requirements of the case study institution. It presents workflow mechanism that enable the institution to easily create, assign and render reports on any given task as well as mechanism to archive, retrieve and assign tasks to existing users. The system was developed using ASP.Net Core 3.1 framework, cascaded style sheet (CSS), hypertext markup language (HTML) and MSSQL server database. The system was hosted on IIS server. Model View Controller (MVC) architecture was adopted in the coding design. This adopted structure enhanced abstraction layer decoupling which enhance code maintainability and scalability and also makes search engine optimization simple.

Keywords— Workflow Management System, Human Resource, Processes Progressive, Web Workflow Mechanism, Cascaded Style Sheet, Model View Controller

1. Introduction

Over the years, workflow management has been designed to provide support for automation of business processes in various organizations across the globe [1,2,3,4,5,6,7]. Workflow management is based on proper understanding of a workflow in an organization and development of requisite technological solution that can be used to associate the people, the task they perform and the interconnectivities that exists among them [8,9,10,11]. The adoption of automation by deployment of workflow management system has been known to improve work efficiency and return on investment of the organization [12,13,14,15,16,17].

Similarly, every organization rely on an array of human resources employed to carry out different tasks or

play different roles that will all gear towards the achievement of the organizational goals [18,19,20,21,22,23]. Such is the case in the tertiary academic institutions where there are different categories of employees that need to be efficiently managed for the proper and efficient functioning of the institutions. The tertiary institutions has several line of activities that operate based on human resource processes. For instance, organization-wide mail management process, student result management process, staff records management process, among others, are all human processes that require careful management to enhance efficiency and productivity of the system [24,25,26,27,28,29,30,31,32,33].

Accordingly, in this paper, a human resource work flow management system that can be applied to a wide range of human processes in the tertiary institution is developed based on a case study of University of Uyo human resource process management procedures. The system is developed as progressive web application to ensure ease of implementation on wide range of platforms such as on mobile devices, on web servers and offline on desktop system. The system is also designed to interface seamlessly with existing software and network infrastructures in the case study institution.

2. Methodology

The Workflow Management System for Human Resource Processes (WMS4HRP) progressive web application (PWA) [34,35,36] was developed using a focus group-based iterative software development method which has the following phases; requirement engineering, planning, designing, coding, testing, integration and deployment. The case study is based on University of Uyo human resource process. Accordingly, the focus group consists of ten members drawn from the various stakeholders that include the university management representative, the human resource directorate representative, the heads of units representative, head of departments/faculty, the clerical staff, representative from the institutional ICT directorate, mail dispatcher representative, workflow management expert from the department management studies and the software development team members. The focus group had several meetings during which they adopted different

techniques to elicit the domain and technical information required for the development of the WMS4HR-PWA. In the course of the focus group meetings existing system workflow was examined and the detailed features of the new system were discussed and developed. Notably, the three tier web application architecture was adopted.

2.1 System Functional Decomposition

At this point, the system features were identified and decomposed into various hierarchy of functionalities (Figure 1). The system functional decomposition in Figure 1 includes: role management module, reporting module,

workflow module, users/staff management module and login module. Each of the functional unit was split into smaller and easy-to-implement units. Furthermore, the detail flowchart or procedure for the implementation of each of the functional unit is presented. For instance, the process flow for login module is presented in Figure 2, which shows that the system prompts for login credentials which comprises of username and password. Once the credentials are entered, the system validates them. If the credentials are correct, the user is redirected to the dashboard else back to the login page as seen in Figure 2.

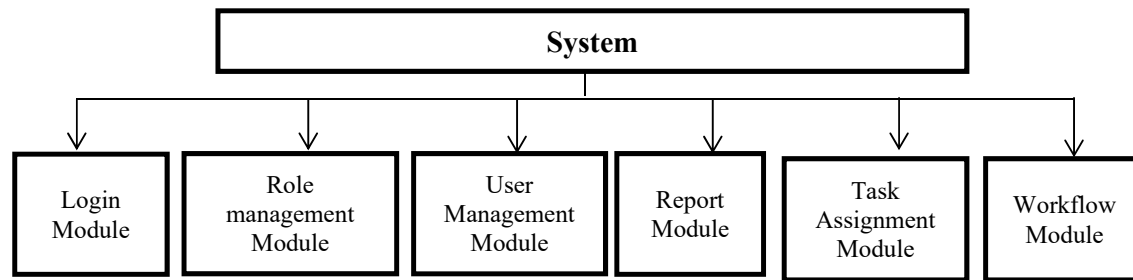


Figure 1: System functional decomposition of the Workflow Management System for Human Resource Processes (WMS4HRP) progressive web application (PWA)

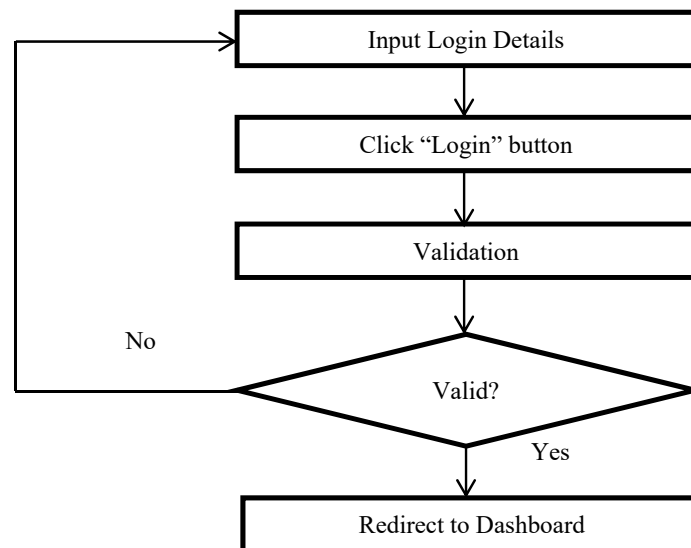


Figure 2: Process flow for Login Module

Generally, the system administrator uses the task creating module to create tasks or roles expected to be performed by the staff or users of the application, then create the user which the roles will be applied to. Users carry out the roles and render reports on their given tasks. The functional decomposition of the role management module is given in Figure 3 while that of user management module is given in Figure 4. This module is only accessed by the administrator who can create a role or edit it, can view list of created roles and can delete role. Since each role has a unique Id (identification), editing or deleting any role requires the role id. For such action as editing or deleting role, the specific role must first be retrieved before the action is performed.

The functional decomposition of the Report Module is shown in Figure 5. This module can be accessed by both the administrator and the user/staff. When a task is assigned to a staff, it is expected that the staff makes reports on what was done. Such staff uses this module to report the work done and then submits to the assigned Verifier. Reports can be generated, edited, viewed or deleted by the user. On the same vein, administrator can write reports and can also access those written by the staff.

The functional decomposition of the Task Management Module is shown in Figure 6. This module is only accessed by the administrator who can create a task or edit it, can view list of created tasks and can delete task. Since each task has a

unique Id, editing or deleting any task requires the task id. For such action as editing or deleting task, the specific task must first be retrieved before the action is performed.

Administrator can assign existing tasks to any existing user as seen in Figure 6 and can monitor the task as performed by the user.

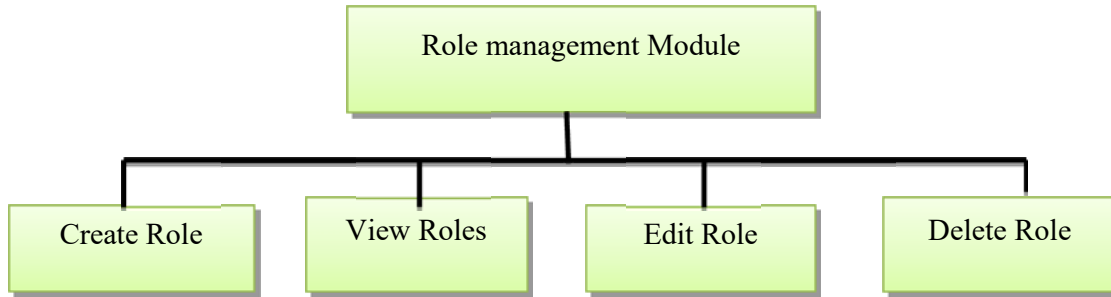


Figure 3: Role Management Module

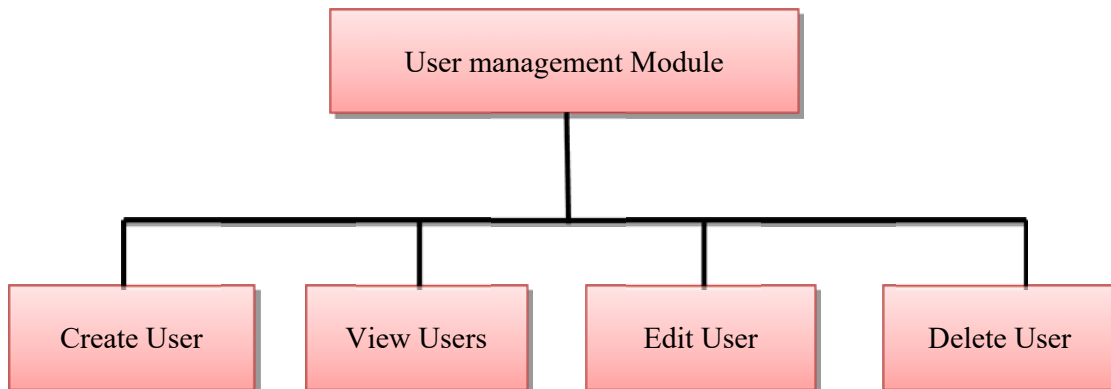


Figure 4: User Management Module

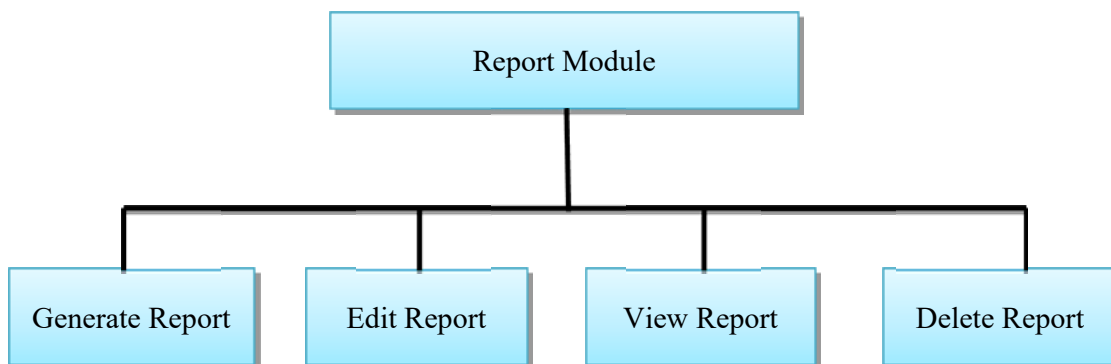


Figure 5: Report Module

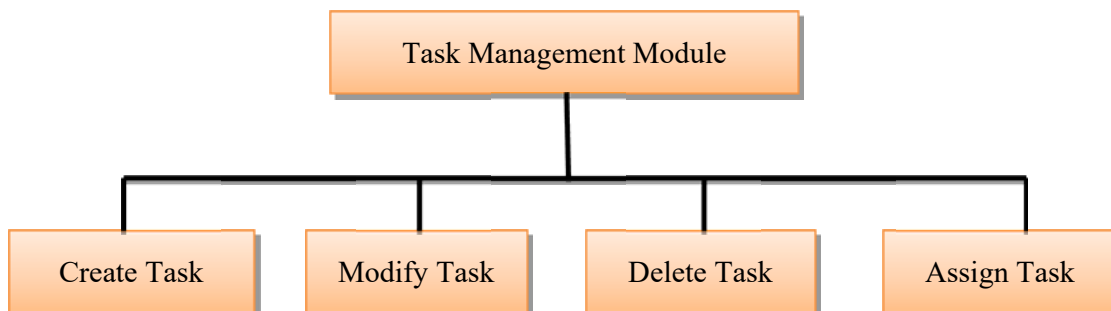


Figure 6: Task Management Module

2.2 Design of the system

2.2.1 The Use-Case Diagram

The model of the WMS4HR progressive web application was done using a Unified Modeling Language (UML). In

the UML, use case diagrams was used in describing the main processes in the system, the interactivity between the main processes (use cases) and external individuals which is known as “actors”. The use-case diagram of the system is show in Figure 7 while the use-case diagram showing the system functionalities is given in Figure 8.

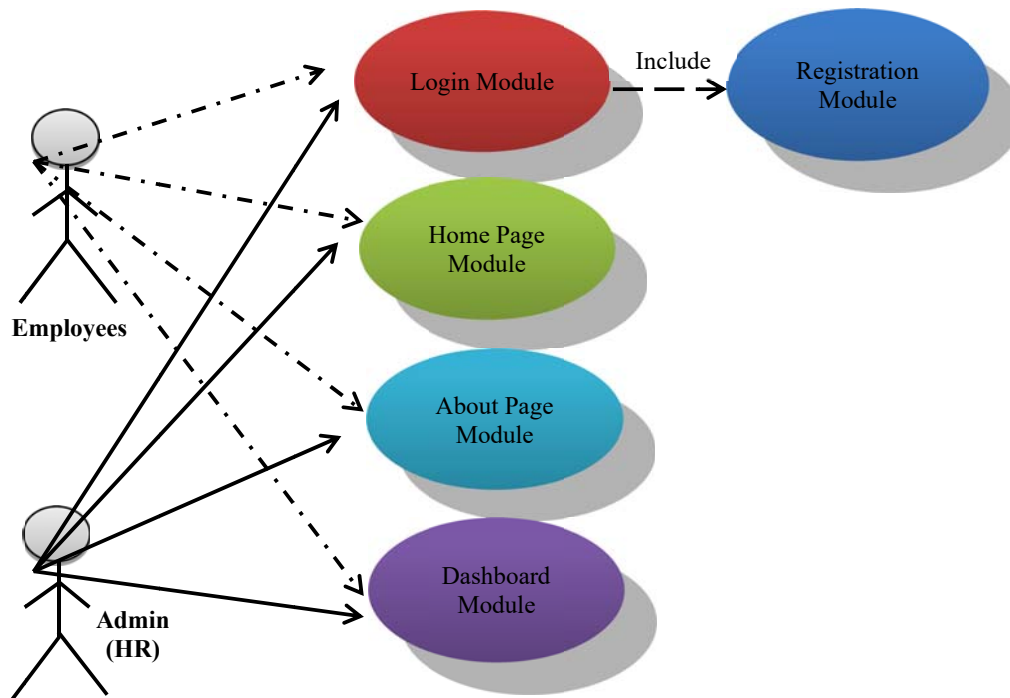


Figure 7 Use-Case Diagram for the System

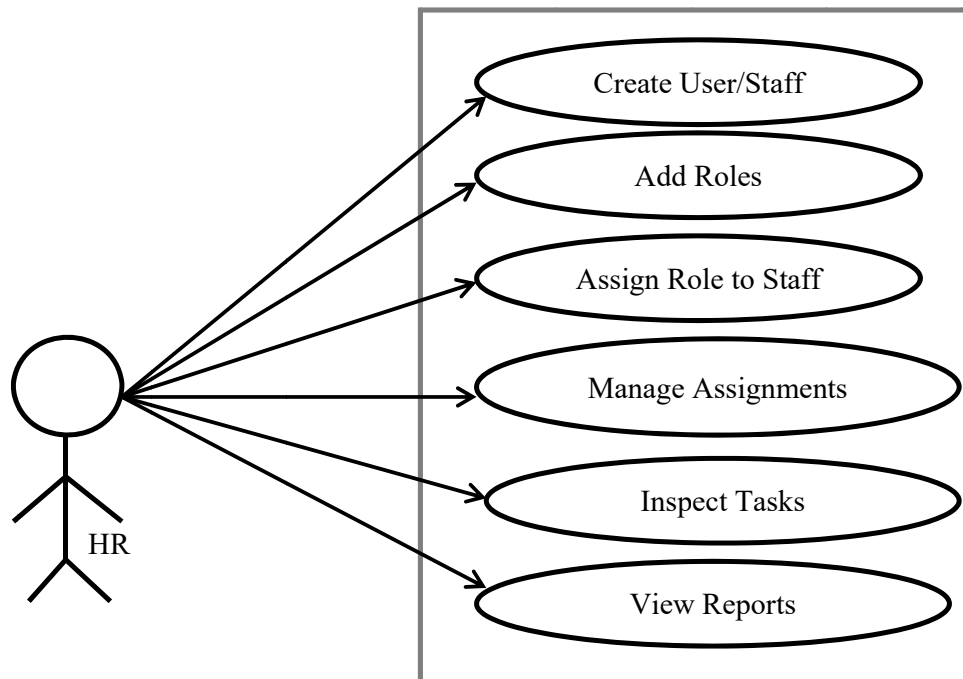


Figure 8: Use-case diagram showing the HR's functionality

2.2.2 The Database Tables

Relational database was used and the Structured Query Language (SQL) was used in the implementation of the database. The database tables structure created and used in the system design are presented in Tables 1 to Tables 4, which include; Table Structure for Users (Tables 1), Table Structure for User Role (Table 2), Table Structure for Tasks (Table 3) and Table Structure for Chat (Table 4).

Table 1: Table Structure for Users

Column	Type	Null
Id (primary key)	Nvarchar(450)	No
UserName	Nvarchar(256)	No
NormalizedUserName	Nvarchar(256)	No
Email	Nvarchar(256)	Yes
NormalizeEmail	Nvarchar(256)	Yes
EmailConfirmed	Bit	Yes
PasswordHash	Nvarchar(MAX)	Yes
SecurityStamp	Nvarchar(MAX)	Yes
CurrencyStamp	Nvarchar(MAX)	Yes
PhoneNumber	Nvarchar(MAX)	Yes
PhoneNumberConfirmed	Bit	No
TwoFactorEnabled	Bit	No
LockoutEnd	Datetime(7)	Yes
LockoutEnabled	Bit	No
AccessFailedCount	Int	No

Table 2: Table Structure for User Role

Column	Type	Null
UserId	Nvarchar(450)	No
RoleId	Nvarchar(450)	No

Table 3: Table Structure for Tasks

Column	Type	Null
Id (Primary Key)	Int	No
TaskName	Nvarchar(256)	No
CreatedOn	Datetime2(7)	No
CompletedOn	Datetime2(7)	No

Table 4: Table Structure for Chat

Column	Type	Null
Id (Primary Key)	Int	No
Title	Nvarchar(256)	No
Body	Nvarchar(256)	No
CreatedOn	Datetime2(7)	No

2.2.3 User Interface Design

The Wired Frame Diagram (WFD) was used for the user interface design. The wire frame for the 'Home Page' is presented in Figure 9. The Home Page basically contains the navigation links and the page banner, and a page footer.

The WFD for About Page is shown in Figure 10. As seen in Figure 10, the WFD for About Page consists of the navigation bars, the researcher's information and the page footer. The WFD for for Dashboard (Figure 3.6) basically comprise of Title bar, page navigation links, User information, User Menus, User Window, and footer.

The system was developed using ASP.Net Core 3.1 framework, cascaded style sheet (CSS), hypertext markup language (HTML) and MSSQL server database. The system was hosted on IIS server. Model View Controller (MVC) architecture was adopted in the coding design. This adopted structure enhanced abstraction layer decoupling which enhance code maintainability and scalability and also makes search engine optimization (SEO) simple

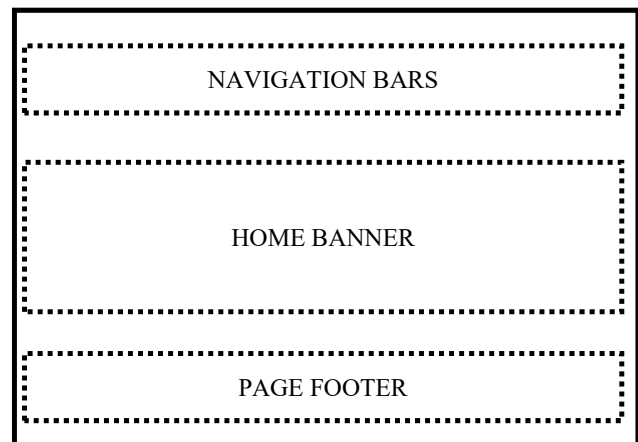


Figure 9: Wire Frame Diagram for Home Page

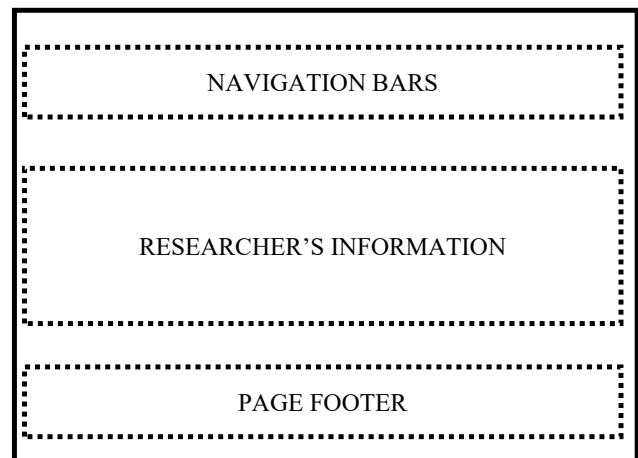


Figure 10: Wire Frame Diagram for About Page

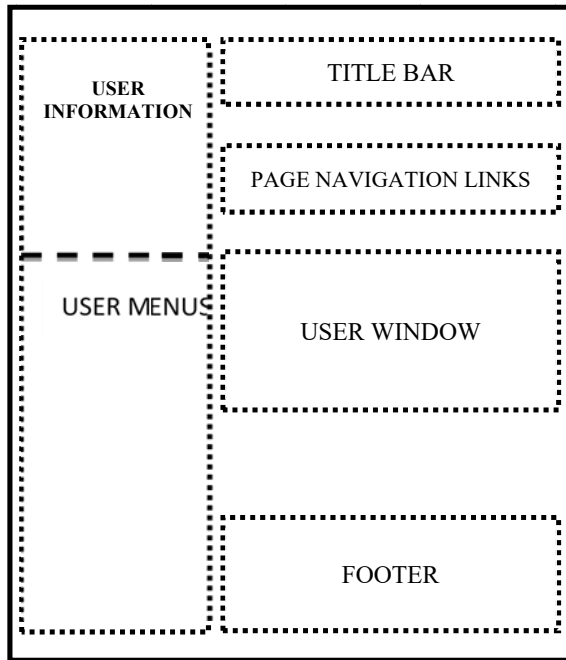


Figure 11: Wire Frame Diagram for dashboard

3. Results and Discussion

The system was implemented and hosted locally and the screenshots of some of the modules are presented as discussed. The screenshot of the Registration Page is given in Figure 13 and it shows where new users are required to sign on by providing key user information and login detail which they will use to login to the system (Figure 14) any other time.

As shown in Figure 13, the fields required by this application for new user registration are: Email, Username, Password, and Confirm Password. On successful login, the application redirects the user to the dashboard which is shown in Figure 15. On the dashboard (the user's sign on landing page), all menus and pages are available based on the user's privileges. These privileges are set by the super Admin.

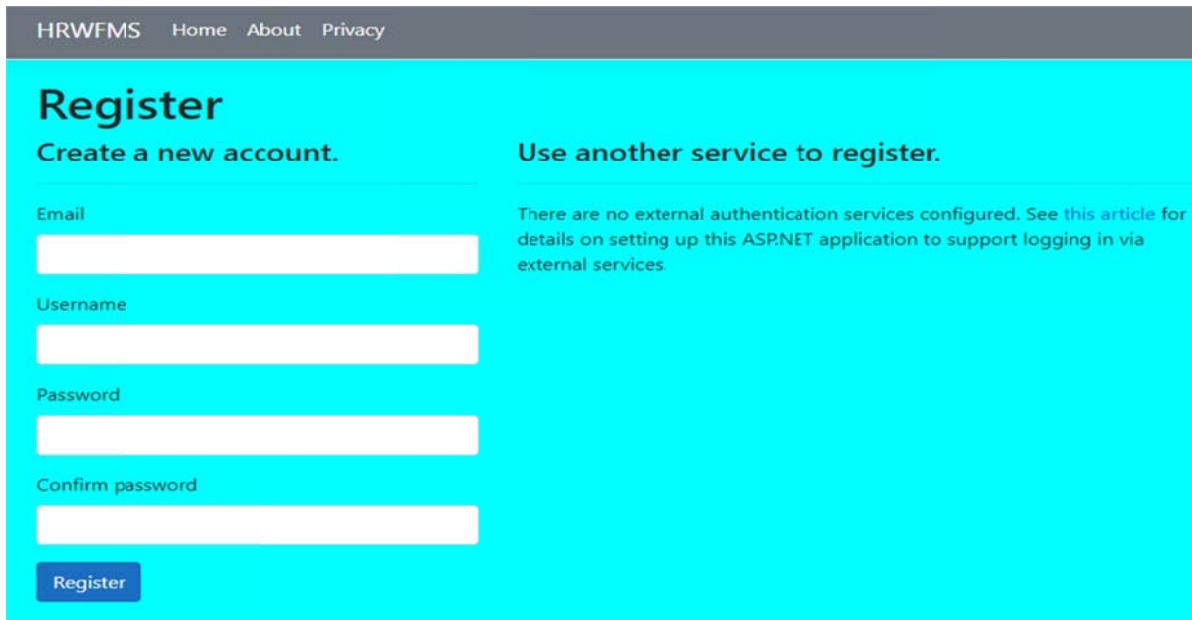


Figure 13 Registration Page

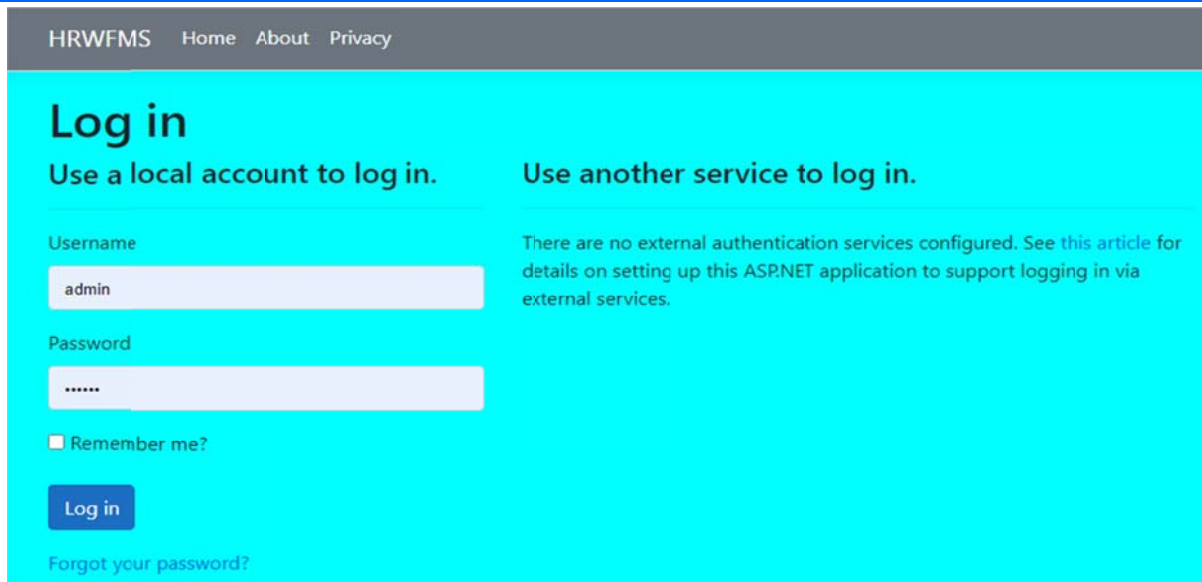


Figure 14 Login Page

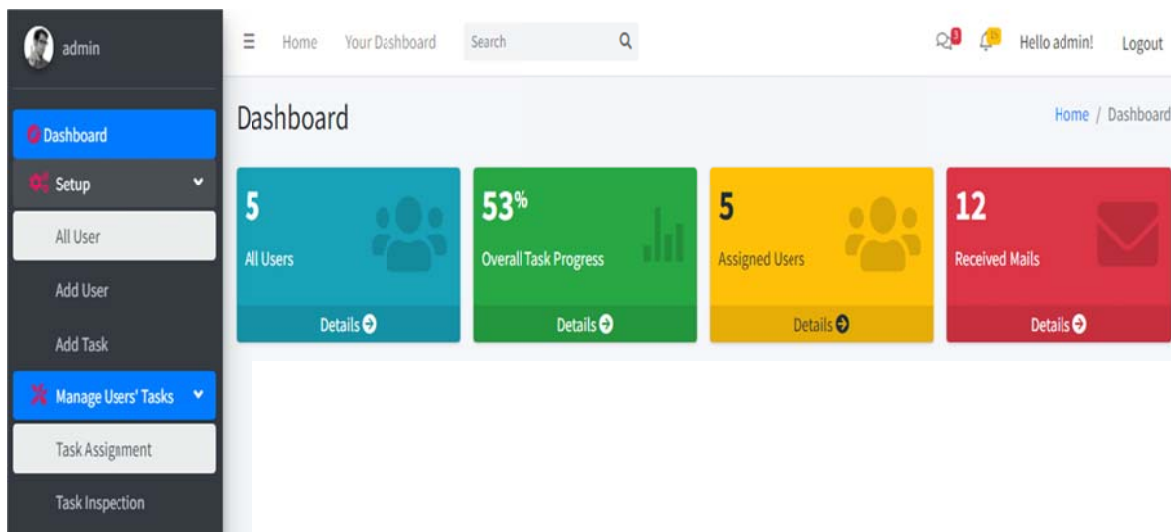


Figure 15 User Dashboard

The dashboard in Figure 15 shows many components such as total number of users, overall task progress, assigned users, and received mails. The All Users page (Figure 16) includes some useful links to manage users. These links include links to: Add user, Edit existing user, view user's details, and delete user. When the Edit button on Figure 16 is clicked, the result is what is seen on Figure 17. In this case, a user by name "Japhet Imoh Otong" was selected in the list to edit. The system identifies the user based on its unique Id and then retrieves the user to display on the editing page.

Once the user is created, such can be assigned task. The task assignment form is shown in Figure 18. just like the user's case, unwanted task can be removed from the system using the page shown in Figure 19. User's Timeline can be viewed to see recent activities carried out by the user. This page is shown in Figure 20. User's Task Timeline page gives useful information about the progress for a given task

for a user. It states the date the task was carried out and the type of task performed. This can be queried between date ranges to view the performance history of a user. Assigned Users List (Figure 20) shows the list of all assigned users by the Admin. Each user's performance on this list can be tracked at any given time and the task can be modified if necessary.

The administrator's workflow management module (Figure 22) shows the module used to create work flow process for the employees. As seen in the Figure 22, various areas where work flow can be created are captured on the module. The administrator has to select the specific area where workflow must be created for a specific task. Once work flow is created, tasks can be assigned to employees using the page shown in Figure 23. Here, the administrator must specify the user/employee who must perform the task, and set timeline for that task

The employee onboarding module is presented in Figure 24 while Figure 25 presents the report module. Every task

performed by users/employees requires report on the report module. This report can be customized and given to the appropriate unit as shown in Figure 25. This module is not

only used by the users/employees but can also be used by the administrator to give an integral report of the organization or appraisal report for users/employees.

The screenshot shows a web application interface for assigning tasks. On the left is a dark sidebar with a navigation menu including 'Dashboard', 'Setup', 'All User', 'Add User', 'Add Task', 'Manage Users' Tasks', 'Task Assignment', and 'Task Inspection'. The main content area is titled 'Assign Task' and contains a form for 'User's Info' with input fields for First Name (Japhet), Middle Name (Inoh), Last Name (Olong), Email (Japhet@gmail.com), and Phone Number (07065214589). To the right is a 'Tasks List' section with a green header and a list of tasks with checkboxes: Assign Courses, Comment/Feedback, Process Results, Vet Results, Submit Results, and Send Emails. At the bottom right of the tasks list are three buttons: 'Back', 'Inspect Progress', and 'Save'.

Figure 18 User Task Assignment Form

The screenshot shows a confirmation page for deleting a task. The page has a light blue background and a white content area. At the top, there is a navigation bar with 'Home', 'Your Dashboard', and a search bar. The main heading is 'Delete Task' in a large, bold font. Below the heading is the question 'Are you sure you want to remove this task?' in a smaller font. At the bottom of the question area are two buttons: a red button labeled 'yes' and a blue button labeled 'No'.

Figure 19: Remove task page.

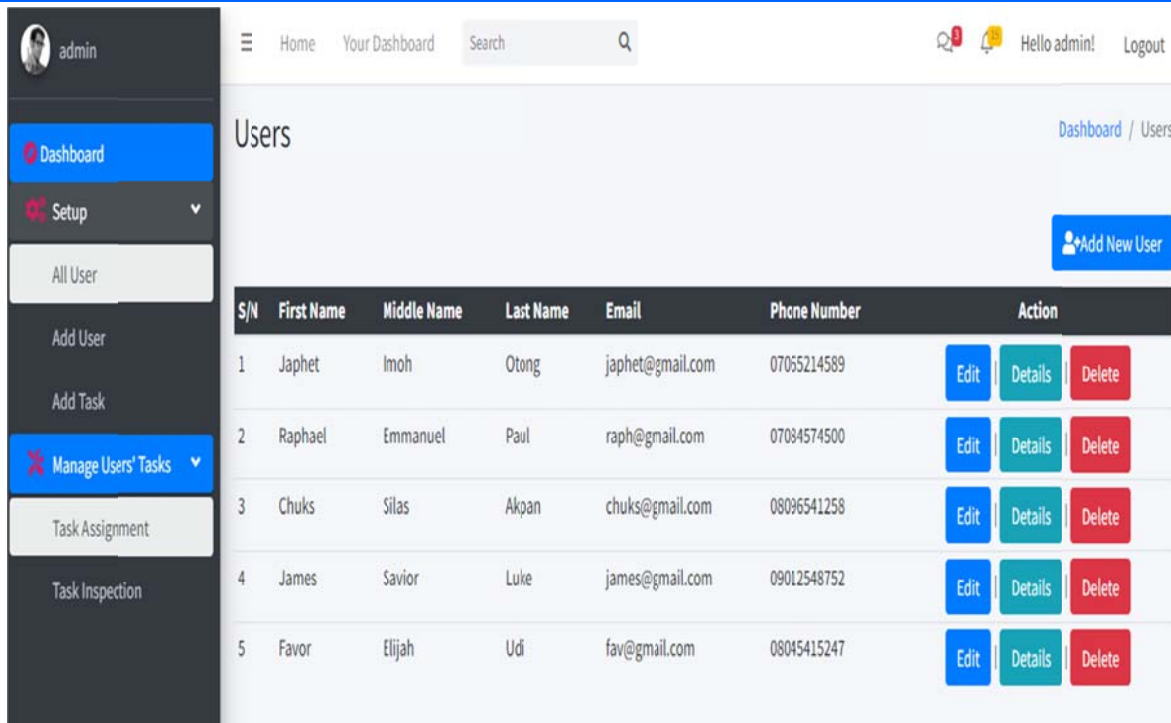


Figure 16 All Users Page

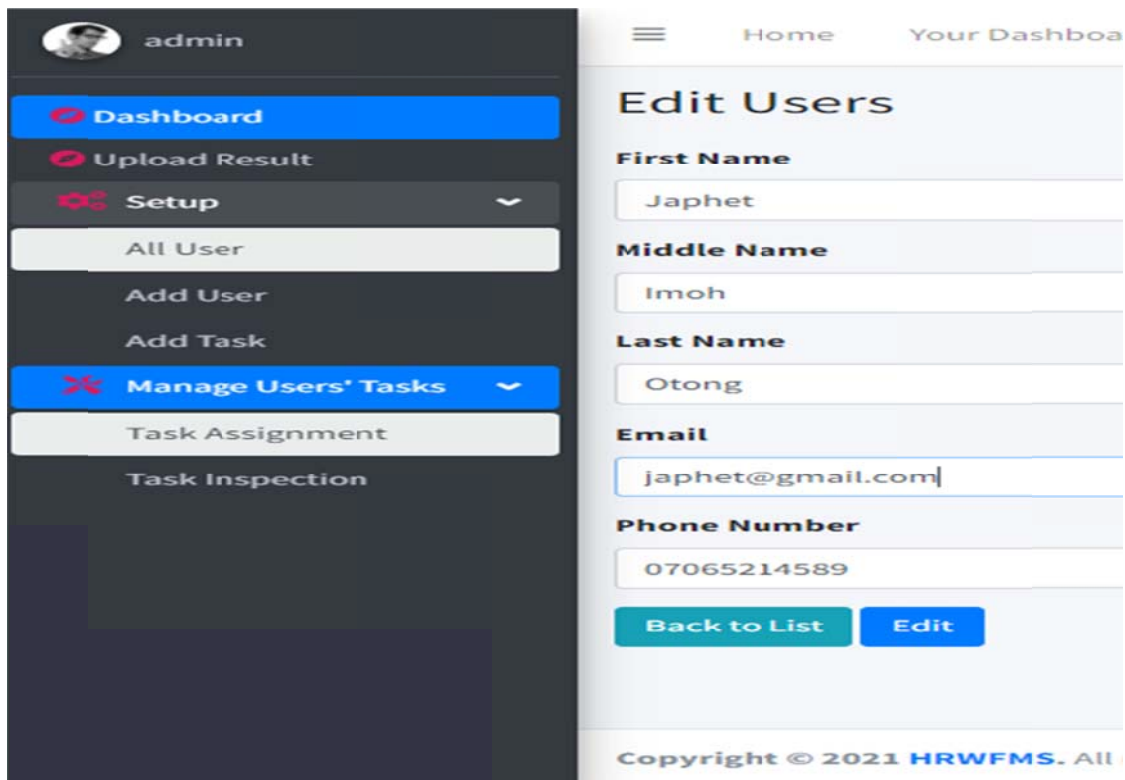


Figure 17: Edit Users Page

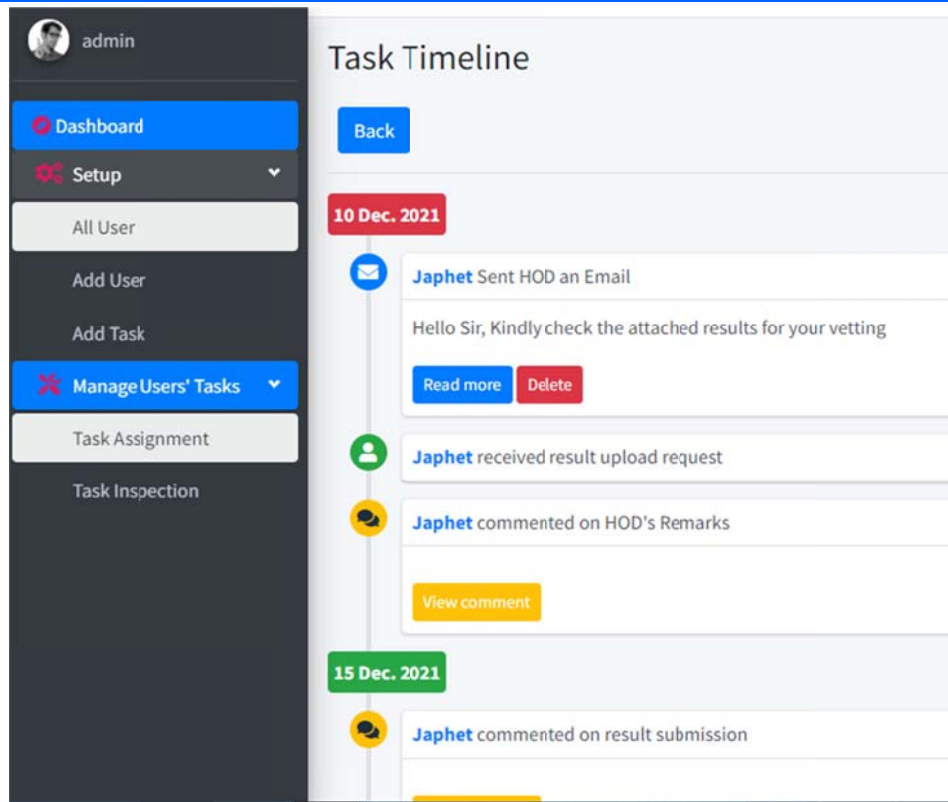


Figure 20 User's Task Timeline

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Figure 22: Admin workflow management module

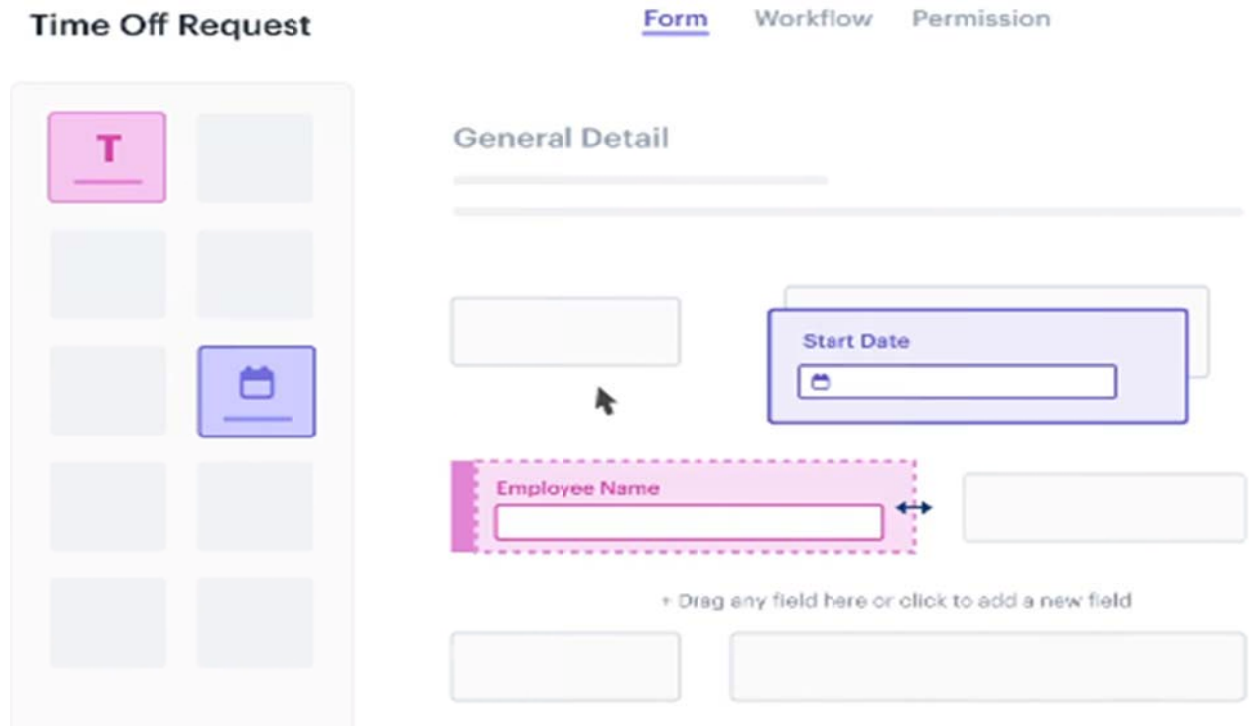


Figure 23: Task assignment module

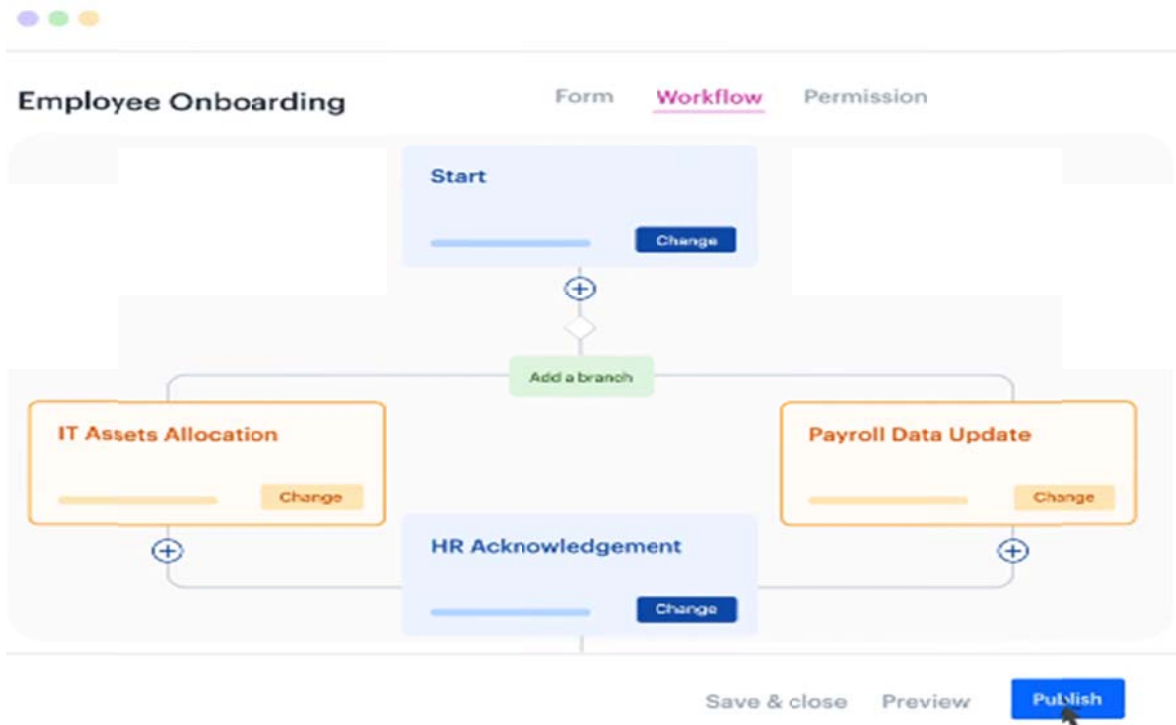


Figure 24: Employee Onboarding module

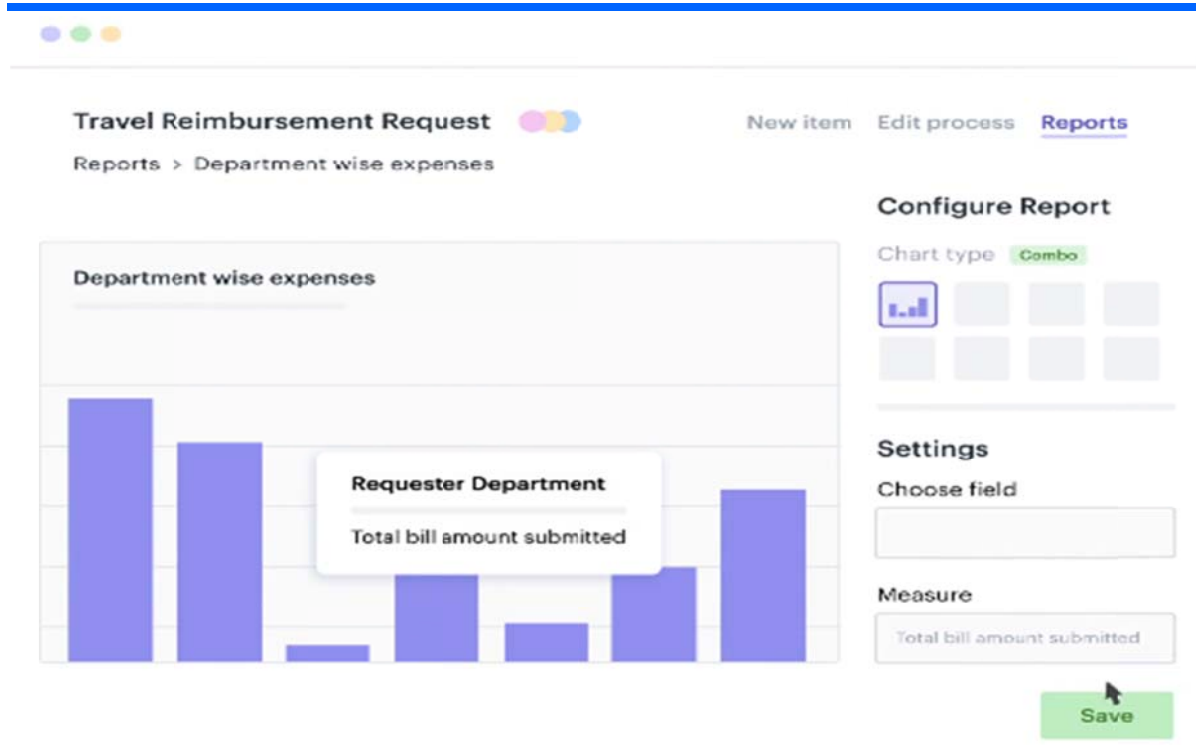


Figure 25: Report Module

4. Conclusion

Development of a human resource management system (HRMS) which is a suite of software applications used to manage human resources and related processes throughout the employee lifecycle is presented. The HRMS enables an organization to fully understand its workforce. The case study used is the work flow in University of Uyo. It was developed as a progressive web application based on the three tier web app architecture. In all, the human resource management in this work affords the organization the ability to run operational reports to track human resource information, complete compliance reporting and improve on the efficiency of its operations.

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