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Development Of Progressive Web App As Service-Based Mechanisms For Charitable Organizations

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***Abstract*— This study presents the development of a progressive web app as service-based mechanisms for charitable organizations which aim at integrating grant management module, fundraising module, cooperative society management module and charitable organization's portal all in one application. This integration has been the major issue with the existing related platforms which primarily has a single functionality per application. The new system presented in this paper is designed to implement the listed different mechanisms in one app. This will drastically minimize the cost of setup and management of web portal and related services for charitable organizations. The system was developed using ASP.Net Core 3.1 framework, along with cascaded style sheet (CSS), hypertext markup language (HTML) and MySQL server database. The system was hosted on Internet Information Services server. With the progressive web app as service-based mechanisms presented in this paper, charitable organizations can focus on their core competence and outsource the services rendered by the mechanisms as it proffers cheaper solution and quick setup time. The system can also be tailored to the specific needs of the charitable organizations.**

Keywords — Grant Management Module, Progressive Web App, Charitable Organization, Fundraising, Cooperative Society Management, Web App As Service, Crowd Funding

1. Introduction

Over the years, charitable organizations have been established to render different kinds of assistance to different categories of beneficiaries [1,2,3,4,5]. Moreover, the growing poverty, tension, violence, pandemic and natural disasters across the globe has also necessitated the need for charitable organizations [6,7,8,9,10,1,12,13]. They help to link the donors to the beneficiaries, providing relevant information that is required to facilitate donations to assist those in need [1,15,16,17].

In many cases, sustainability of the charitable organizations is essential to ensure stable support programs. In that wise, the charitable organizations set up businesses and cooperative societies to cater for the need of the beneficiaries [18,19,20,21,22,23]. They also engage in various fundraising programs to sustain their fund base for their programs.

Among other things, application of information and communication technologies is essential for the smooth operation of the charitable organizations and also to enable them to have global visibility and access to fund and other supports [24,25,26,27,28]. Accordingly, majority of the charitable organizations with international reach use web portals to connect with their partners, donors and beneficiaries. However, recent development has prompted for more robust web portals for charitable organizations. Such web portals should have features for grant management, fundraising and cooperative management mechanisms. These features are lacking in many of the available web portals for charitable organizations. Furthermore, many charitable organizations do not have the requisite expertise and fund to develop and maintain such robust web portals. Consequently, in this paper, we present a robust progressive web app-as-service solution that will integrate the diverse functionalities into one application which is designed to run effectively on the web server, on mobile devices and on offline desktop system. The details of the design and implementation of such system are presented in this paper.

2. Methodology

The development of the progressive web app (PWA) as service-based mechanisms for charitable organizations was conducted using iterative incremental software development method. The developer has fair knowledge of the required user and system functionalities and also has access to available online platforms that have different aspects of the desired user and system functionalities. As such, the main task is to select the desired functionalities from the different existing platforms and design a one platform that can implement the diverse functionalities in a single application. In this wise, the software development method adopted works by first identifying the entire functionalities of the new web application, prioritizing the functionalities in the order of implementation, and then

developing the functionalities one at a time, while implementing unit test, integration and integration test in each iteration. Notably, every iteration adds a new functionality to the previous version of the application.

Based on the study of several existing charitable organizations' web portals, and the trend in the operations of contemporary charitable organizations, the following key mechanisms are required to be integrated into the web applications for such organizations, namely; grant management mechanism, cooperative society management mechanism and crowd funding mechanism. Also, such services need to be fully dynamic and easy to configure to suite the different needs of different categories of charitable organizations. In addition, the web application need to be designed to be rendered as web app as service. This will enable the charitable organizations to subscribe to such services and thereby save the cost of setting up and maintaining independent web portal for their operations. Accordingly, the key modules in the Progressive Web App for Charitable Organizations (PWA4CO) as captured during the requirement elicitation and analysis phase of the software development are presented in the Unified Modeling Languages (UML)-based use case diagram of Figure 1.

The functional decomposition of the Progressive Web App for Charitable Organizations is presented in Figure 2. The modules include Registration Module, Login Module, Home Page Module, About Page Module, Contact Page, Module, Admin Module, Blog, Crowd Funding Module, Grant Management Module and Cooperative Management Module. Every user in must register and subsequently login to access any key module in the application. Upon login, the user will have access to the Home Page with menu items as listed in Figure 3.

The functional decomposition for the 'About Us Module' is given in Figure 4 while the functional decomposition for the 'Contact Module' is given in Figure 5. Similarly, the functional decomposition for the 'Crowd Funding Module' is given in Figure 6 while the 'Crowd Funding Module' process flow diagram is given in Figure 7. Likewise, functional decomposition for the 'Grant Management Module' is given in Figure 8 while the 'Grant Management Module' process flow diagram is given in Figure 9. Furthermore, functional decomposition for the 'Cooperative Management Module' is given in Figure 10 while the 'Cooperative Management Module' process flow diagram is given in Figure 11.

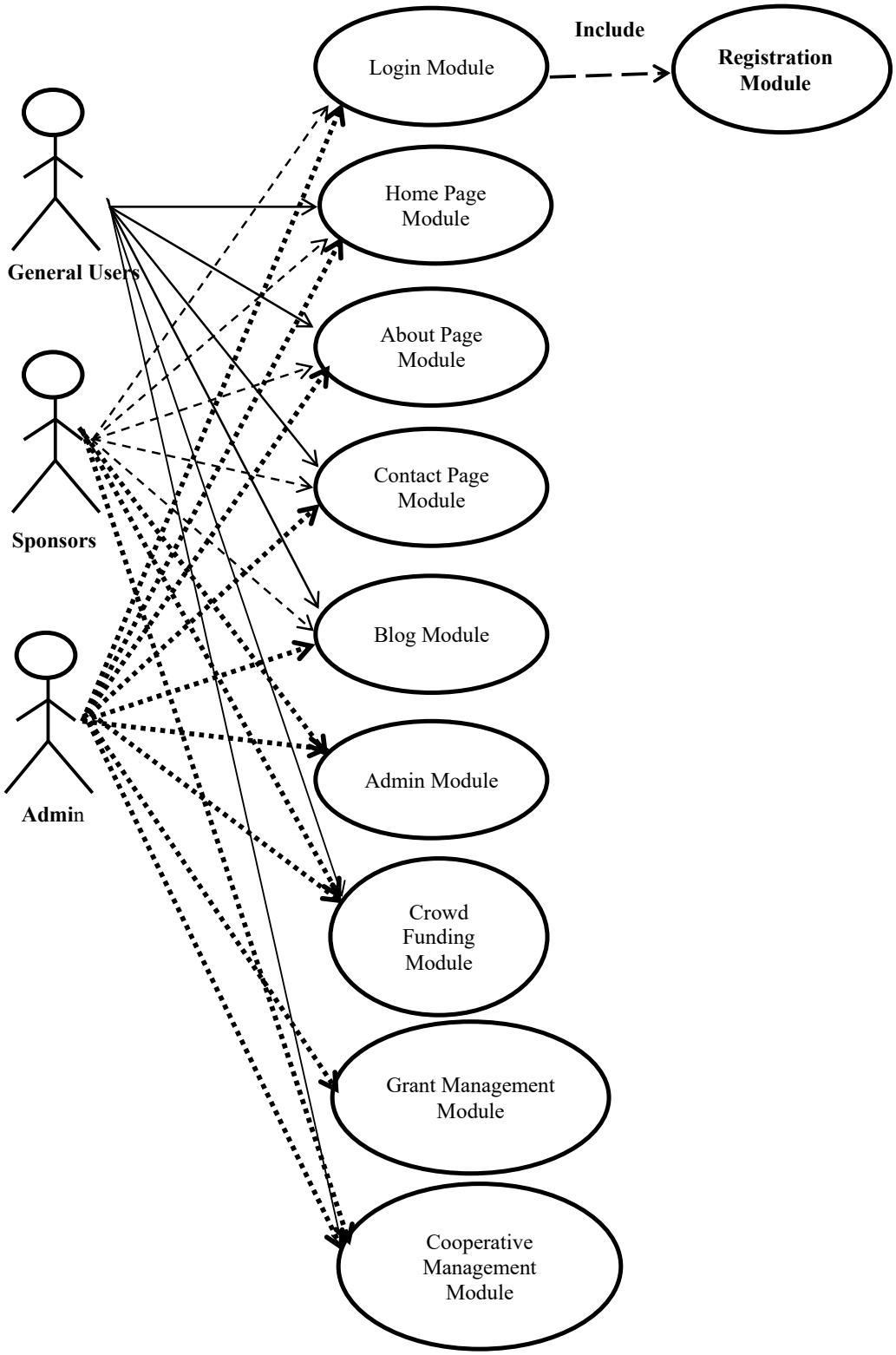

Figure 1 The use-case diagram for the progressive web app for charitable organizations

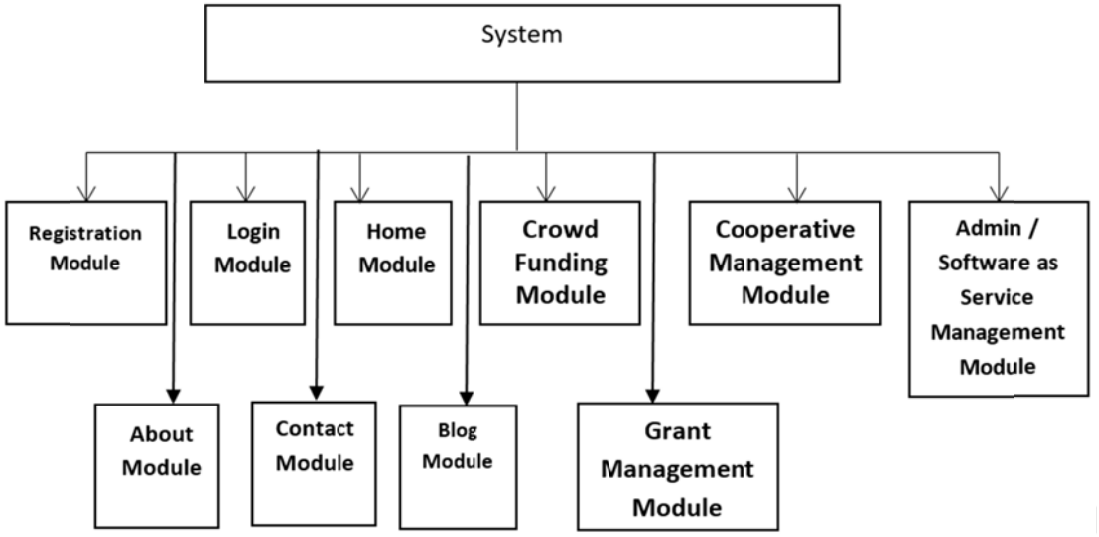

Figure 2: Functional decomposition for the functional decomposition of the progressive web app for charitable organizations

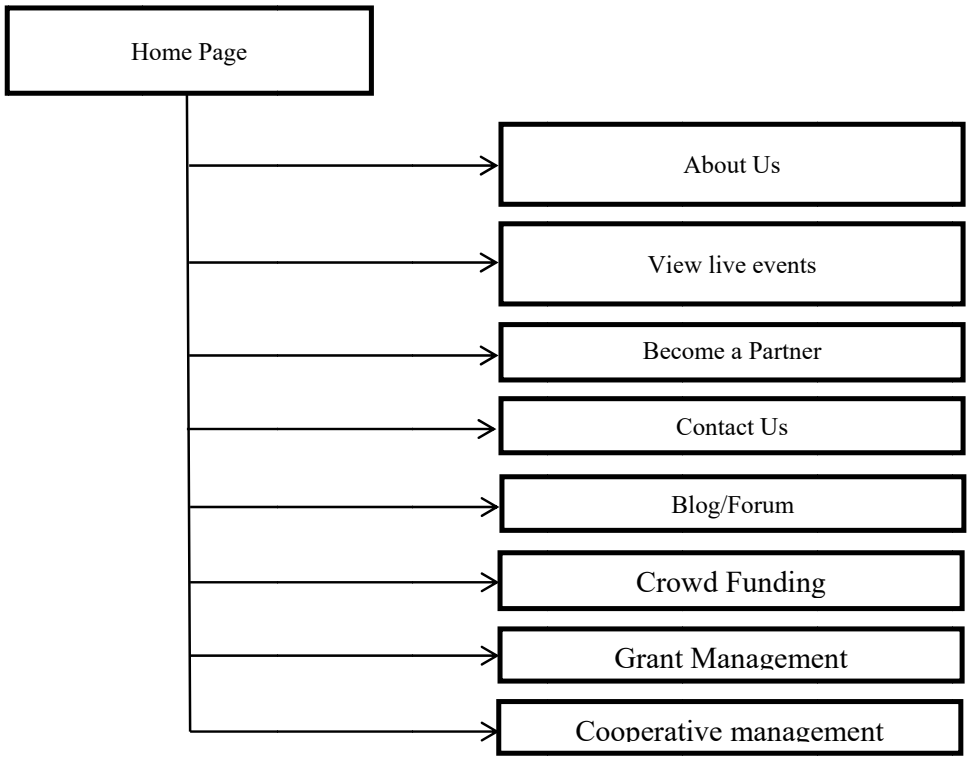

Figure 3: Functional decomposition for the Home page Module

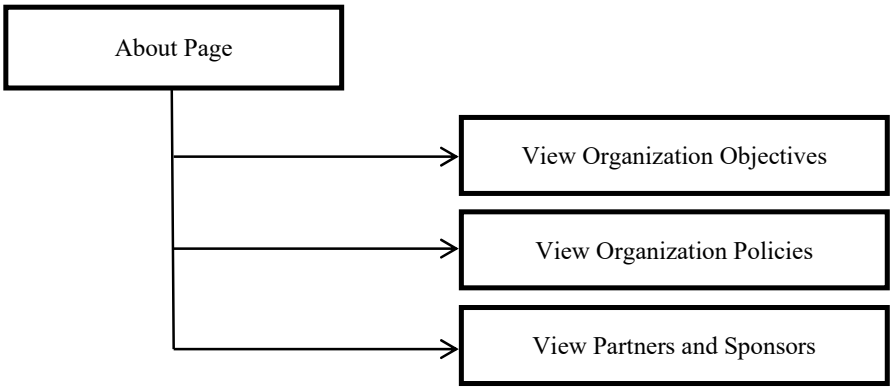

Figure 4: Functional decomposition for the About Page Module

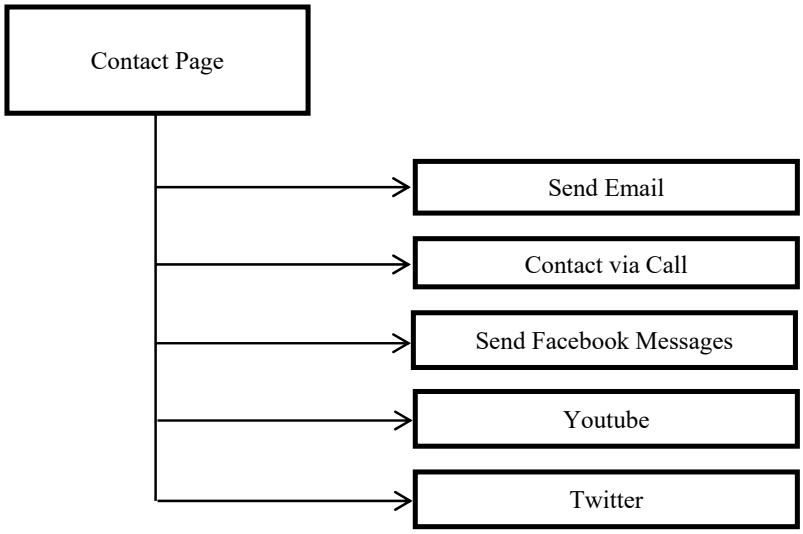

Figure 5: Functional decomposition for the Contact Page Module

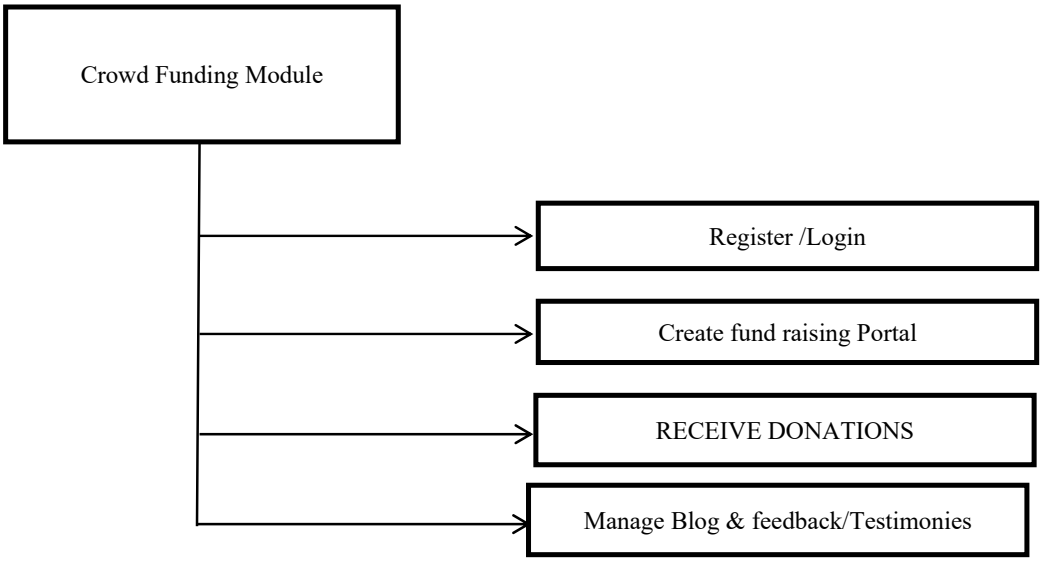

Figure 6: Functional decomposition for the Crowd Funding Module

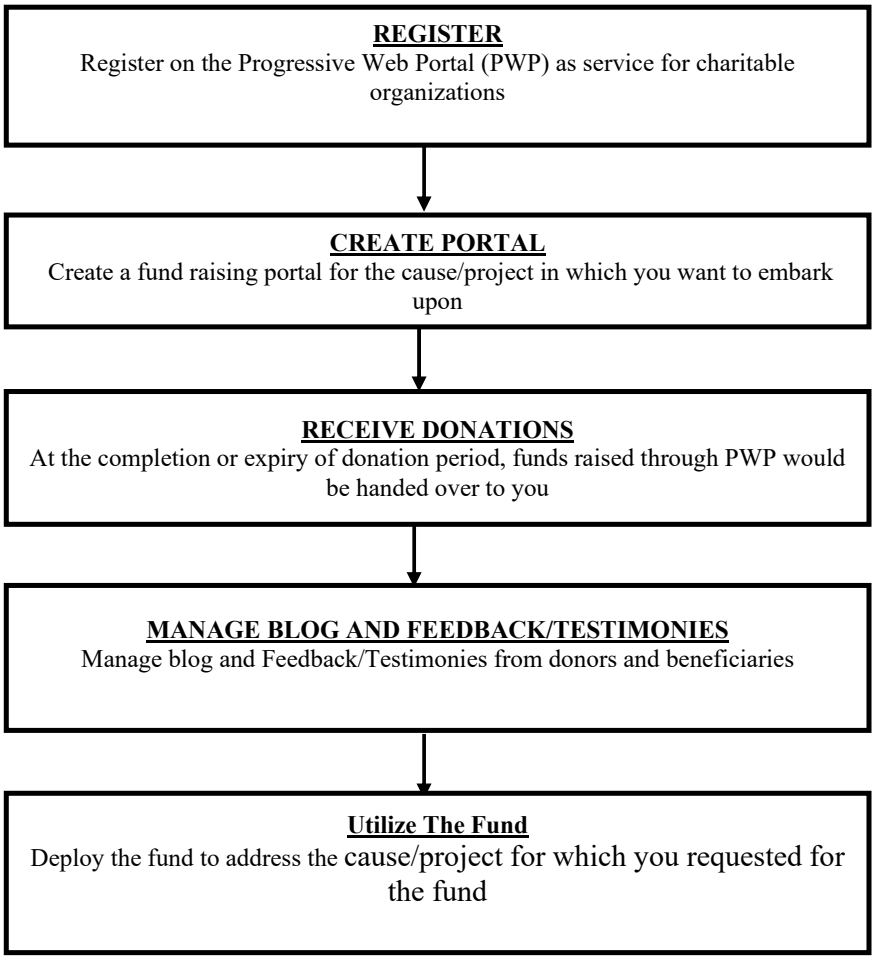

Figure 7: Crowd Funding Module Process Flow Diagram

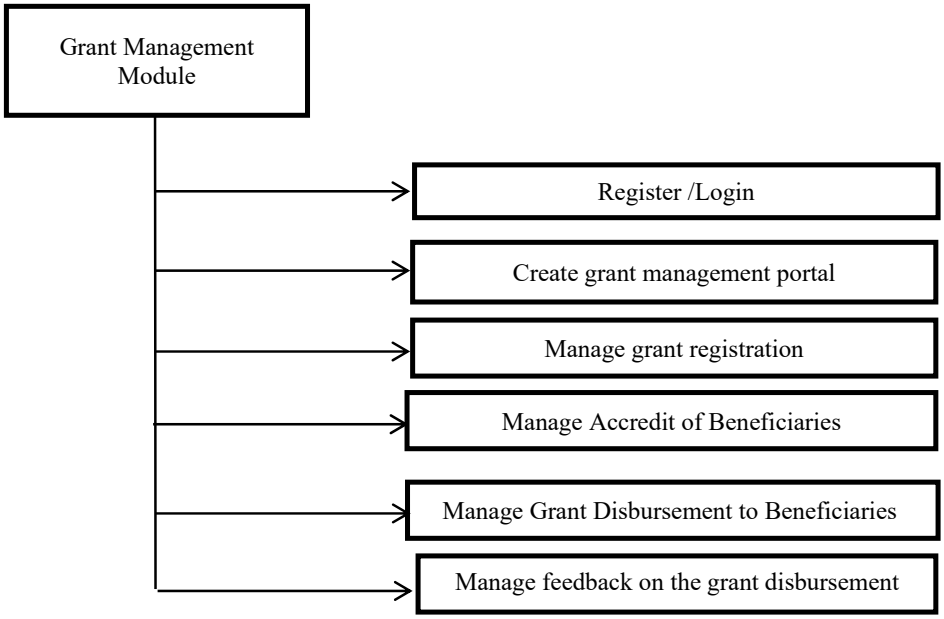

Figure 8: Functional decomposition for the Grant Management Module

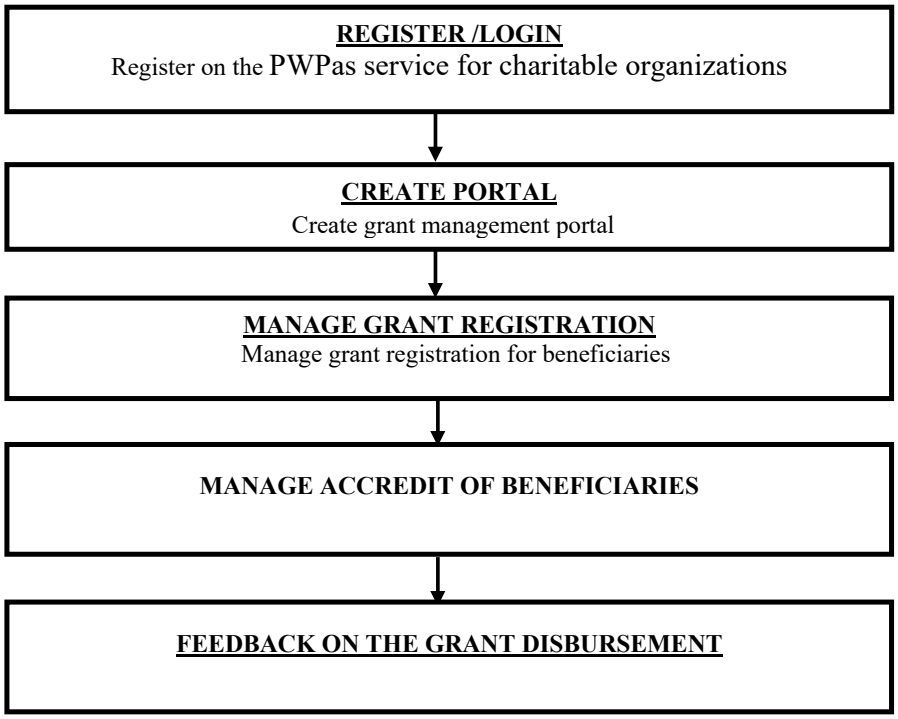

Figure 9: Grant Management Module Process Flow Diagram

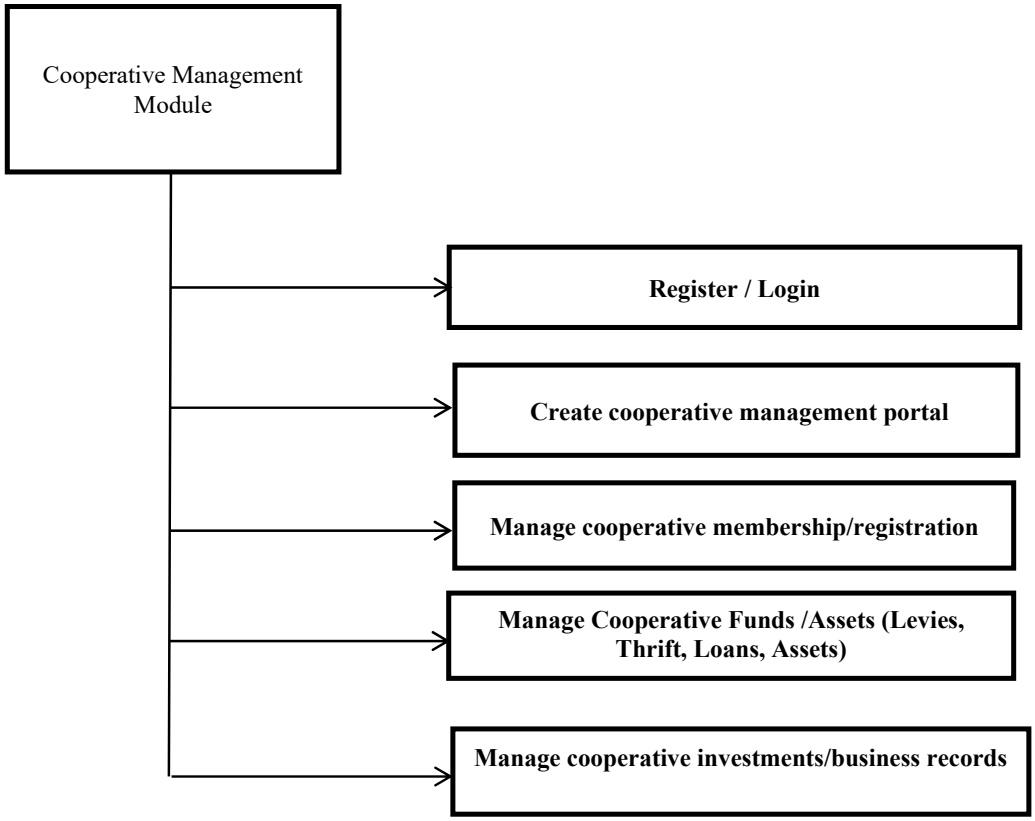

Figure 10: Functional decomposition for the Cooperative Management Module

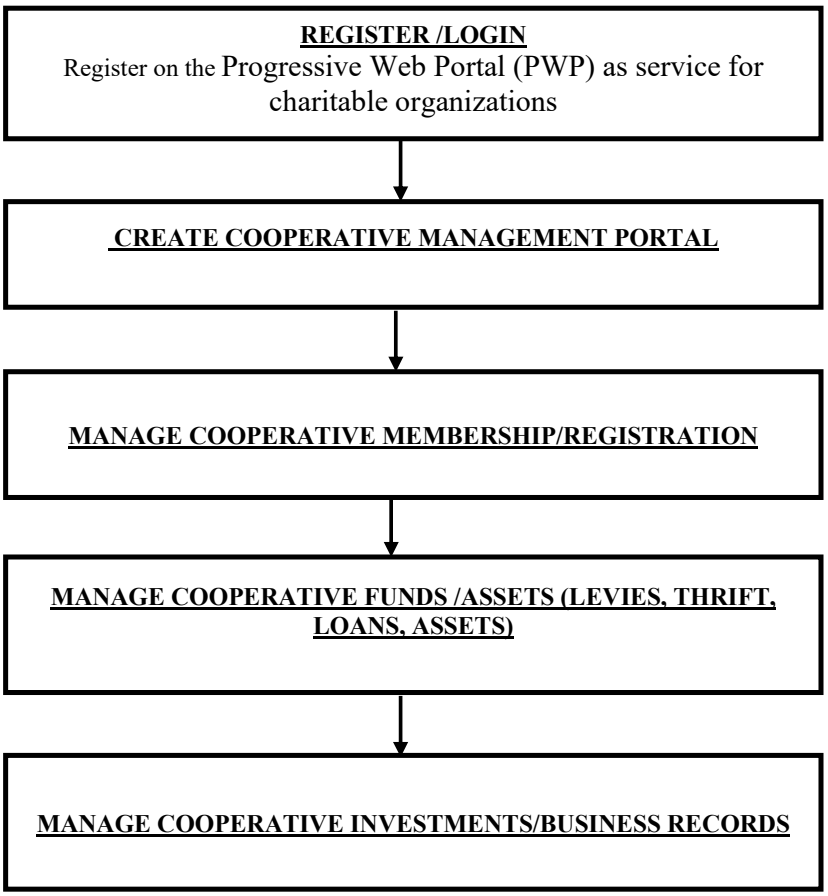

Figure 11: Grant Management Module Process Flow Diagram

The front end layout design is presented using Wired Frame Diagram (WFD) . The wire frame diagram for the Home Page is shown in Figure 12. Accordingly, Figure 12 gives the template for the layout of the contents and menu items in the home page which basically comprises of title bar and logo, page header containing menu items and links to other pages, home banner, organization objective, organization responsibilities, live events section, volunteers section and footer. The wire frame diagram for user's backend dashboard is shown in Figure 13. Notably, Figure 13 gives the template for User's Backend Dashboard which basically comprise of Title bar, page navigation links, User information, User Menus, User Window, and footer.

The system was developed using C# and ASP.Net Core 3.1 framework, along with cascaded style sheet (CSS), hypertext markup language (HTML) and MySQL server database. The popular coding pattern known as Model View and Controller (MVC) was used throughout the coding phase. The system was hosted on Internet Information Services web server.

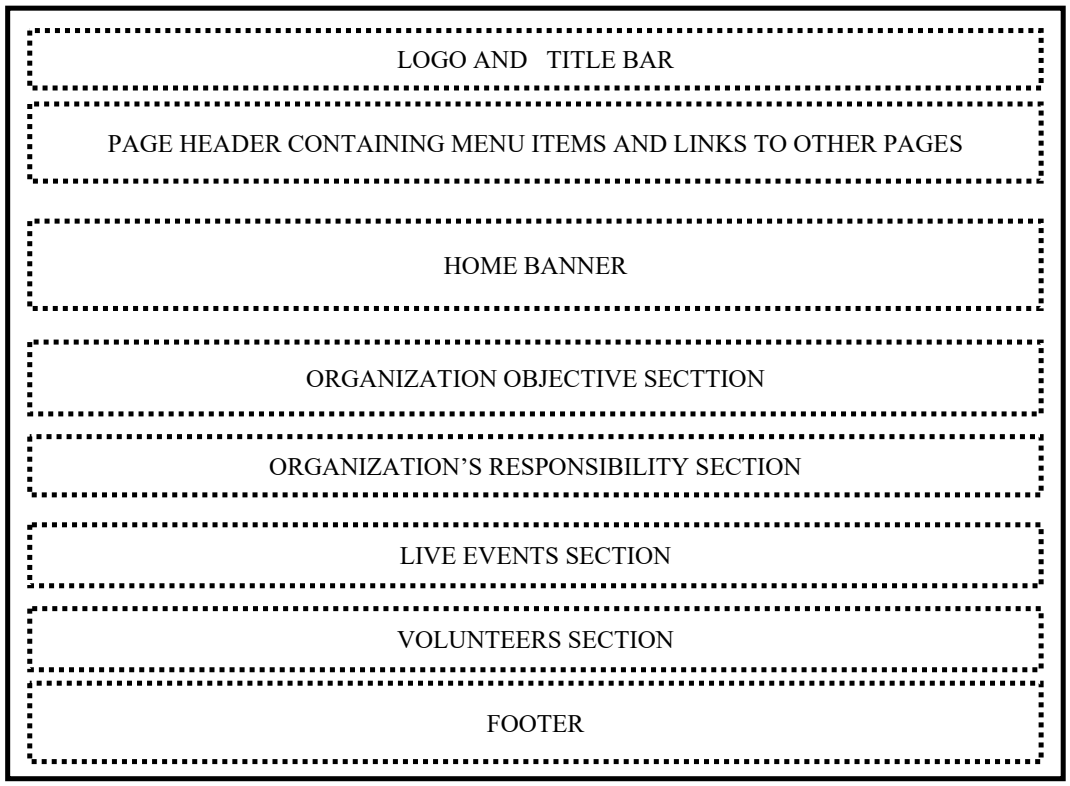

Figure 12: Wire frame diagram for the Home Page

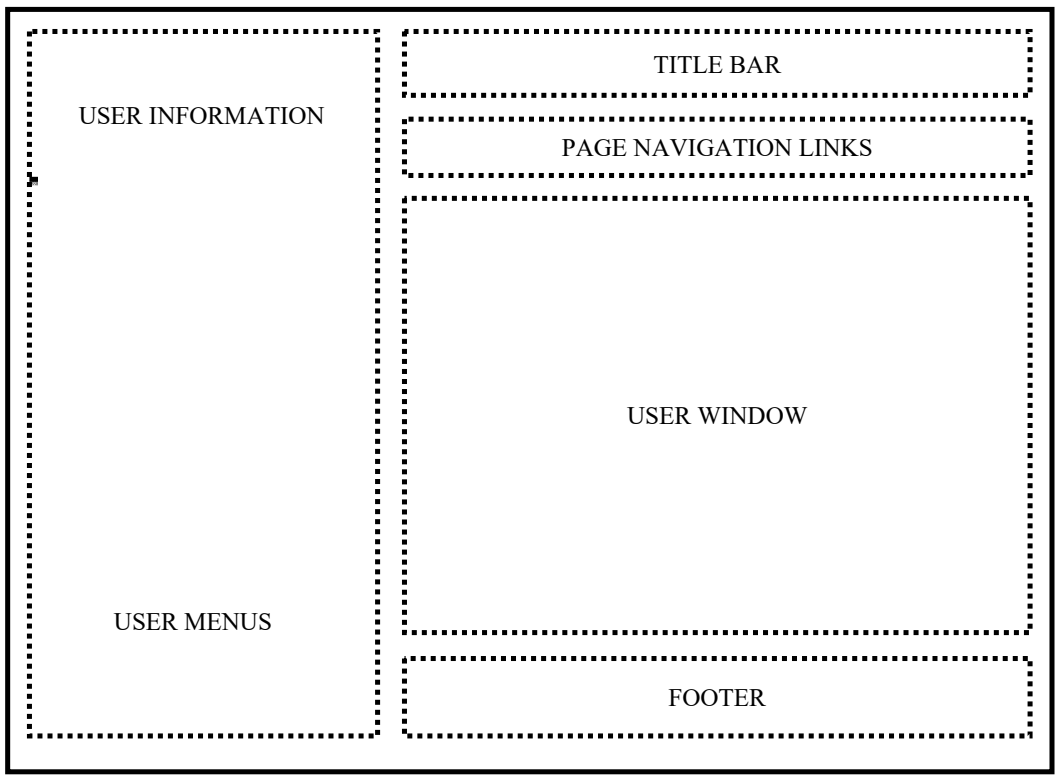

Figure 13: Wire frame diagram for the for User's Backend Dashboard

3. Results and Discussion

The Home page is given in Figure 14. As seen in Figure 14, the banner section of the home page has a link for donations by partners or volunteers along with other links that enable users to navigate to About page, Contact page, Blog, Login and many other useful links.The Home page link that shows the Charitable Organization's objective is presented in Figure 15. This is where the organization's objective is stated. The objective is a dynamic content which can be managed directly by the website Admin without the intervention of the developer.

The home page section where the organization state showing featured welfare programs and solicit for donation is shown in Figure 16 while Figure 17 shows the webpage where the Charitable Organization presents there Events. This is where the organization updates or publishes their upcoming events. This section is also managed by the admin, independent of the developer.

The web portal Admin dashboard is shown in Figure 18. This is where the Admin can manage the site contents, access privileges and configurations. The admin has access to create more users, edit or delete them as the case may be. There is also access here to monitor every contribution made by volunteers. Access is also given from the dashboard for blog management. When the Admin Home link is clicked, it redirects the administrator to the page shown in Figure 19. The administrator can further select which component of the home page to manage. The web portal objectives management page is shown Figure 20. The administrator uses this page to manage the contents of the charitable organization objectives on the web portal. The cause or welfare program content management pages is shown in Figure 21. This is the page where the administrator states the charitable organization's reasons for existence of their cause or welfare programs.

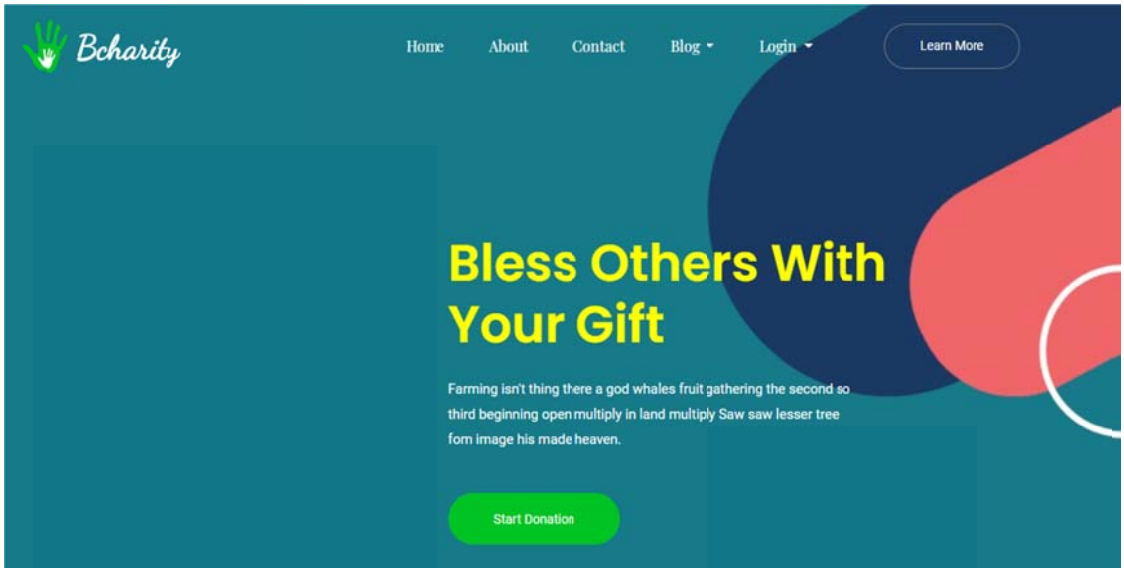

Figure 14: Home Page showing the Banner section and Donations link

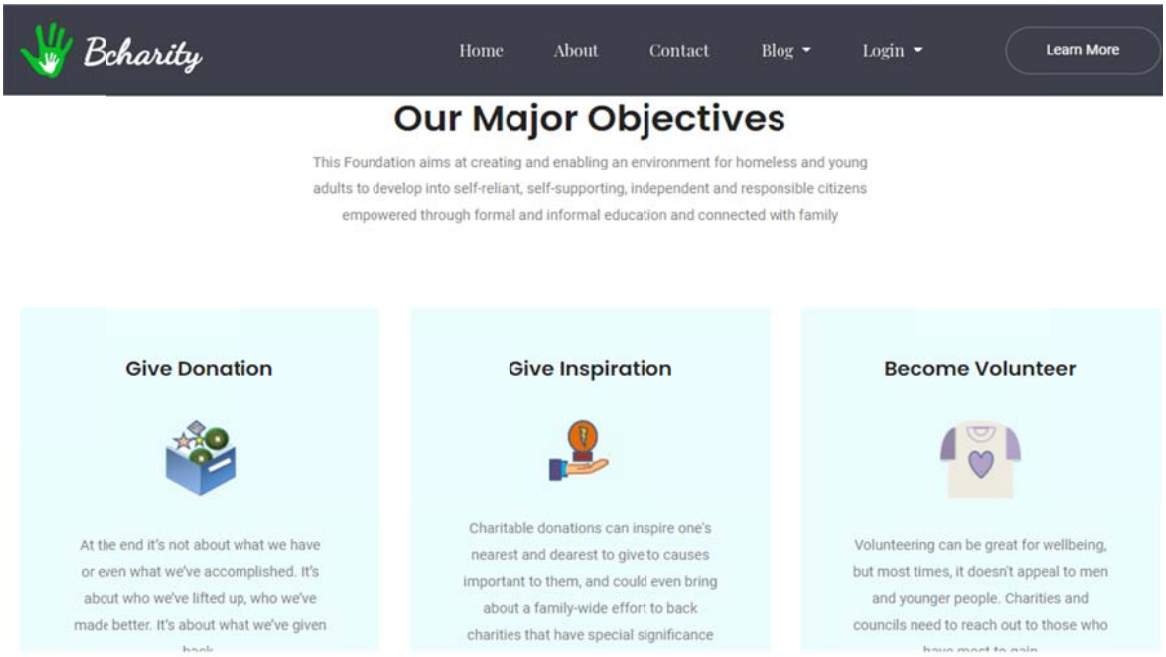

Figure 15: Home page showing the Charitable Organization's Objective Section

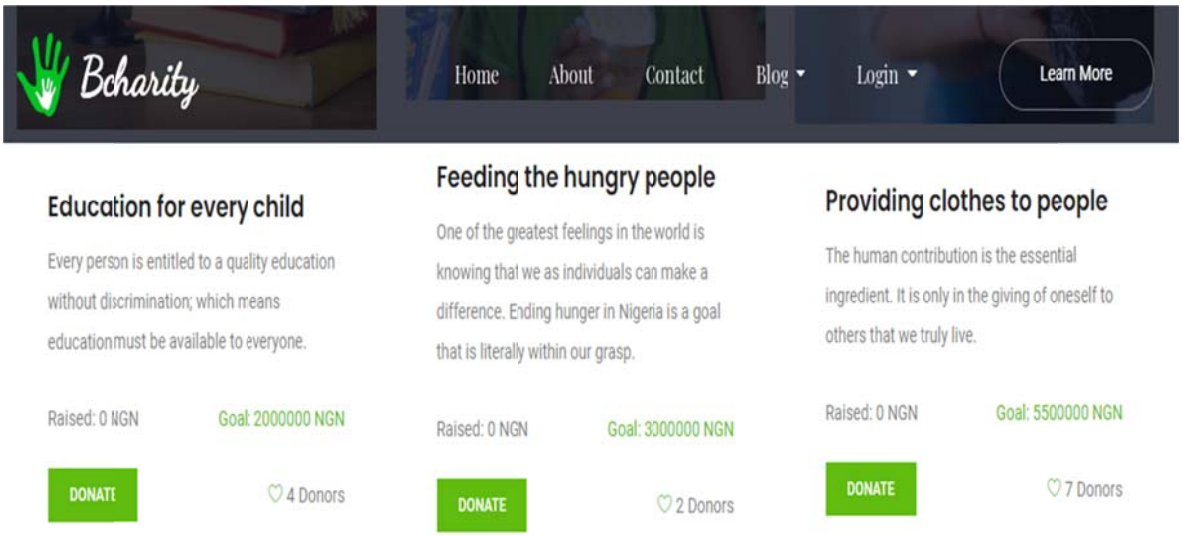

Figure 16: Home page showing featured welfare programs and solicit for donation

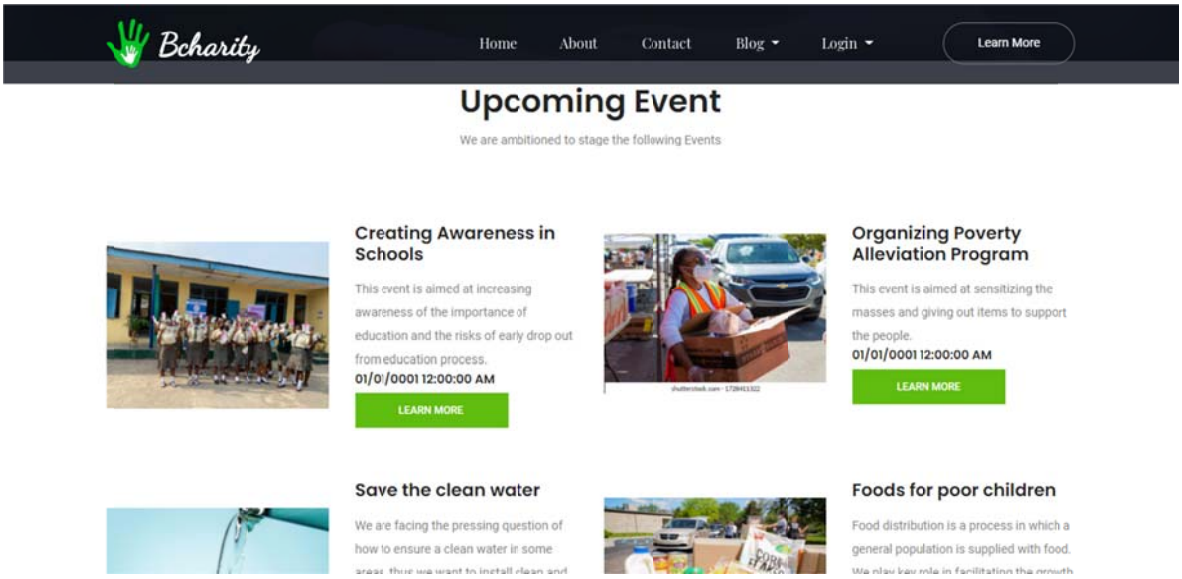

Figure 17: Home page showing Events

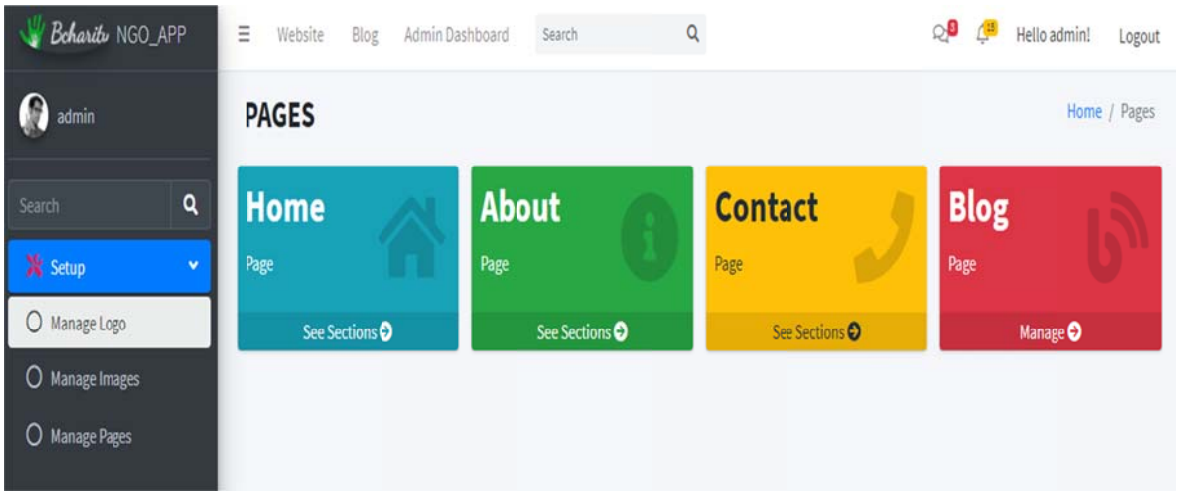

Figure 18 : Admin Dashboard

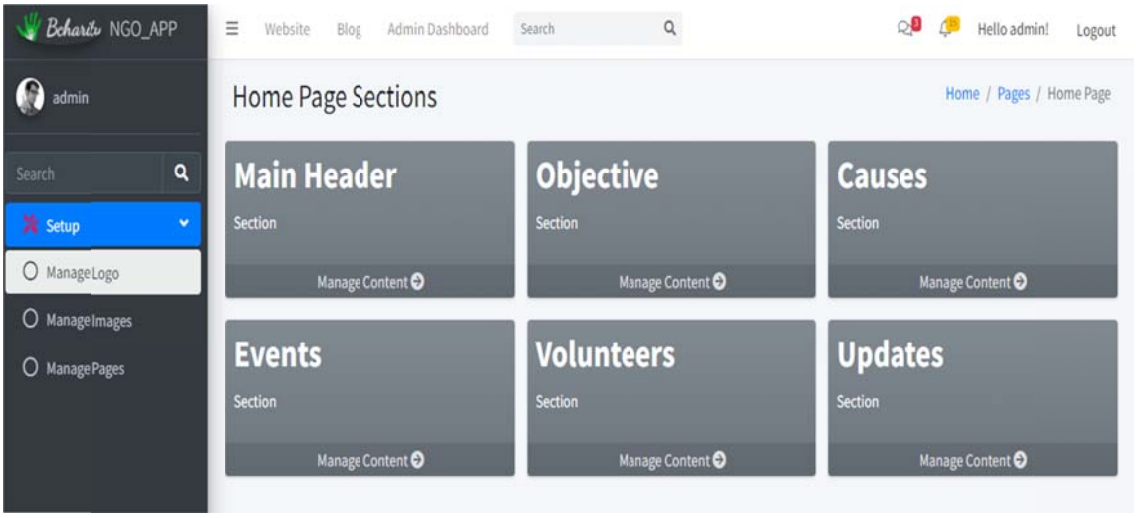

Figure 19 Admin Home Page

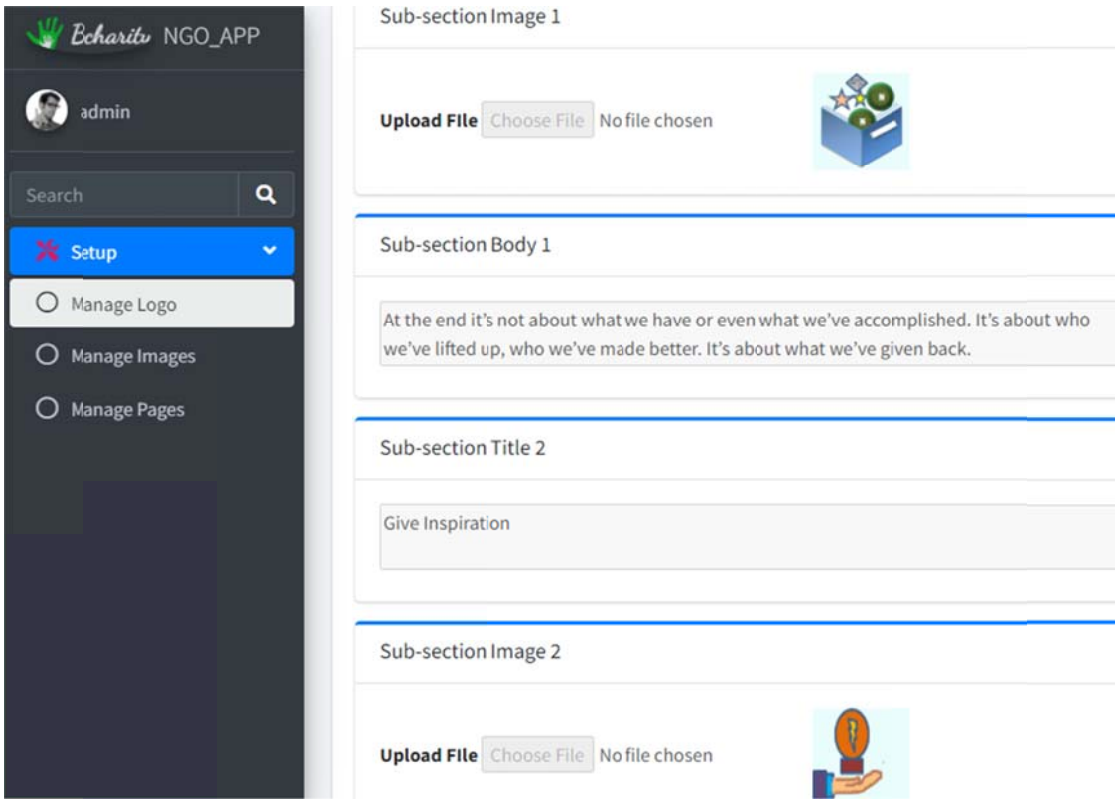

Figure 20: Objective Content Management Page

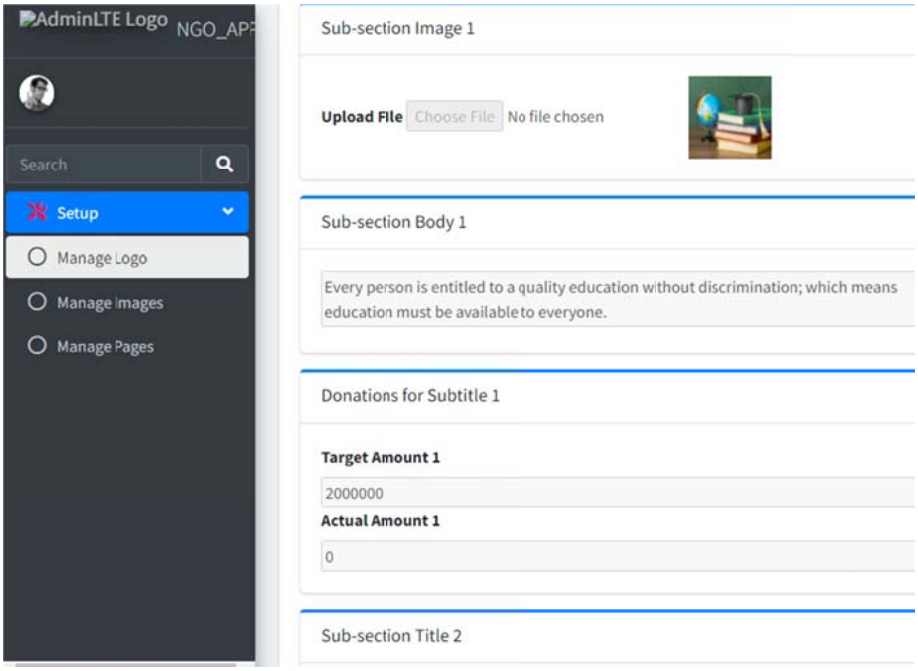

Figure 21: Cause or Welfare Program Content Management Page

The homepage for cooperative management module is shown in Figure 22. This landing page of the cooperative module allows users to create the cooperative or association accounts. The page in Figure 23 shows some operations in the cooperative society which includes, membership enrollment, automated contributions and lending automation process. The statistics dashboard for the cooperative society is shown in Figure 24. This is where the summary of activities carried out the each society is rendered. Information captured here include: Total number of registered members, total number of loans collected, the society's wallet information such as total savings and total expenditures for a given period of time. The cooperative mobile device management page (Figure 4.23) shows where the application's subscribers can manage their profile and activities on the cooperative website with their mobile device. Also, on this page, the website admin can manage cooperative settings and options, add and manage members directly from mobile device.

The grant management module home page is shown in Figure 26. On this page, prospective users can request for a demo of the application. The summary of the grant management module components is shown in the application dashboard on Figure 27. Information such as revenue collection, beneficiaries' information, and grant disbursement information are captured on the dashboard. The fundraising application dashboard is shown in Figure 28. The dashboard captures information such as total donors, donor retention, total gifts, and statistical analysis of donations and solicitations.

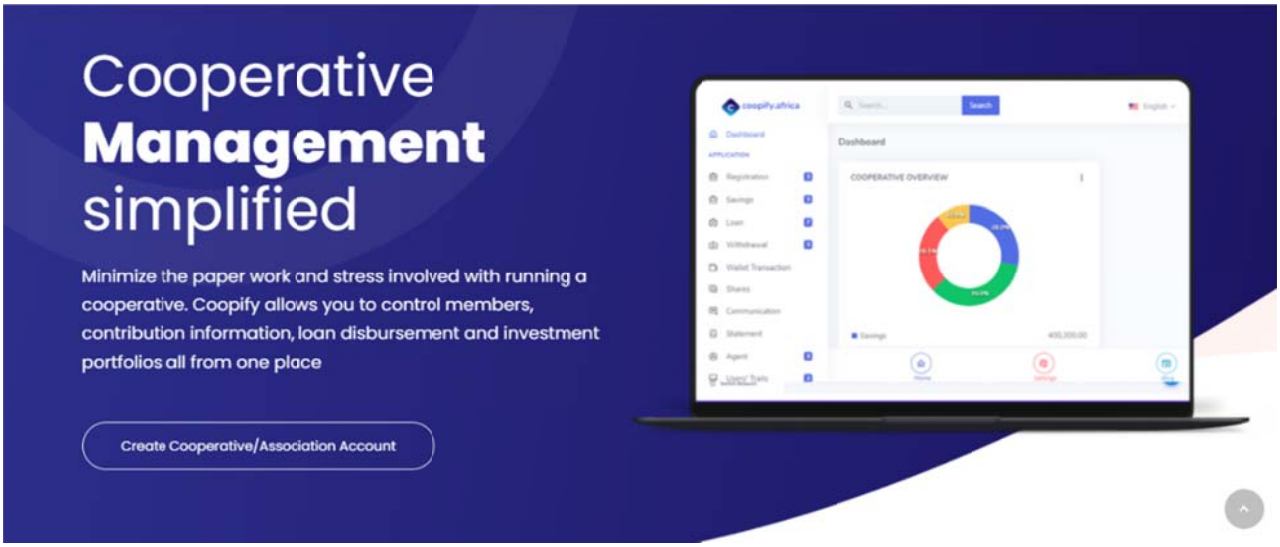

Figure 22: The cooperative management module - Home Page

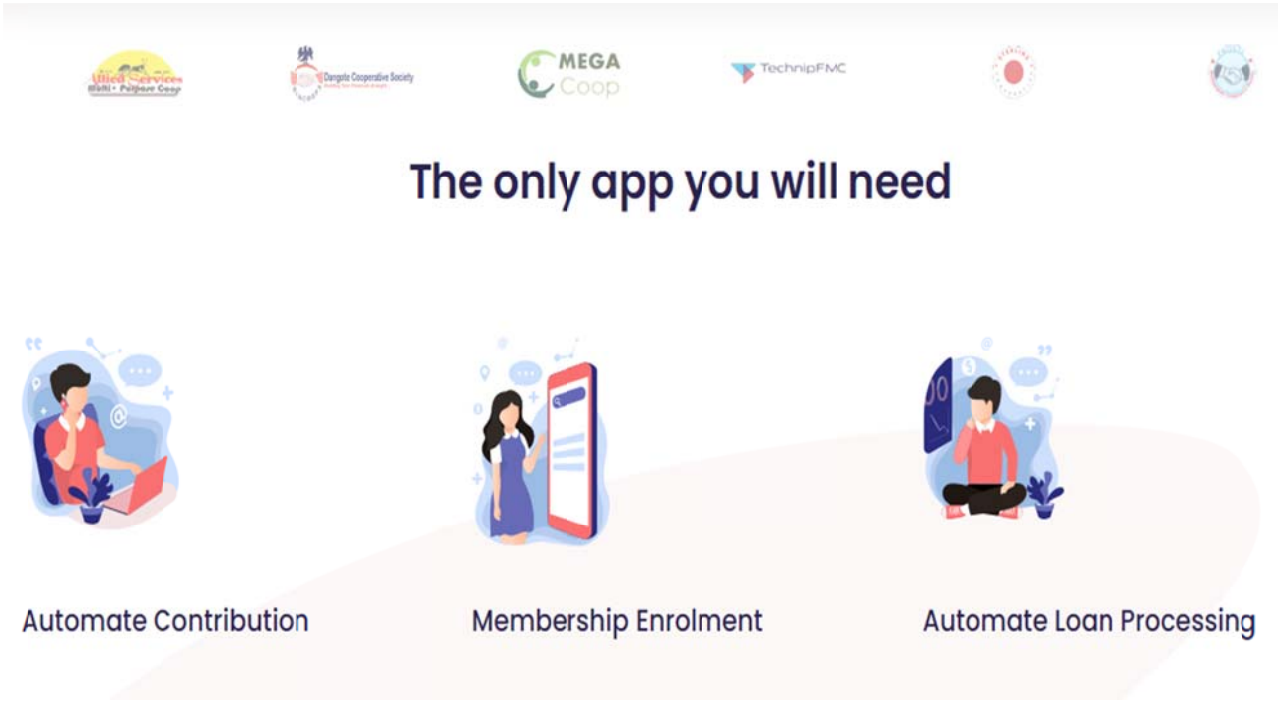

Figure 23: Cooperative Module – App deliverables

Figure 24: Cooperative modules – Statistics Dashboard and data analytic page

Figure 25: Cooperative Module – Mobile device management

Figure 26: Grant Management Module – Home page

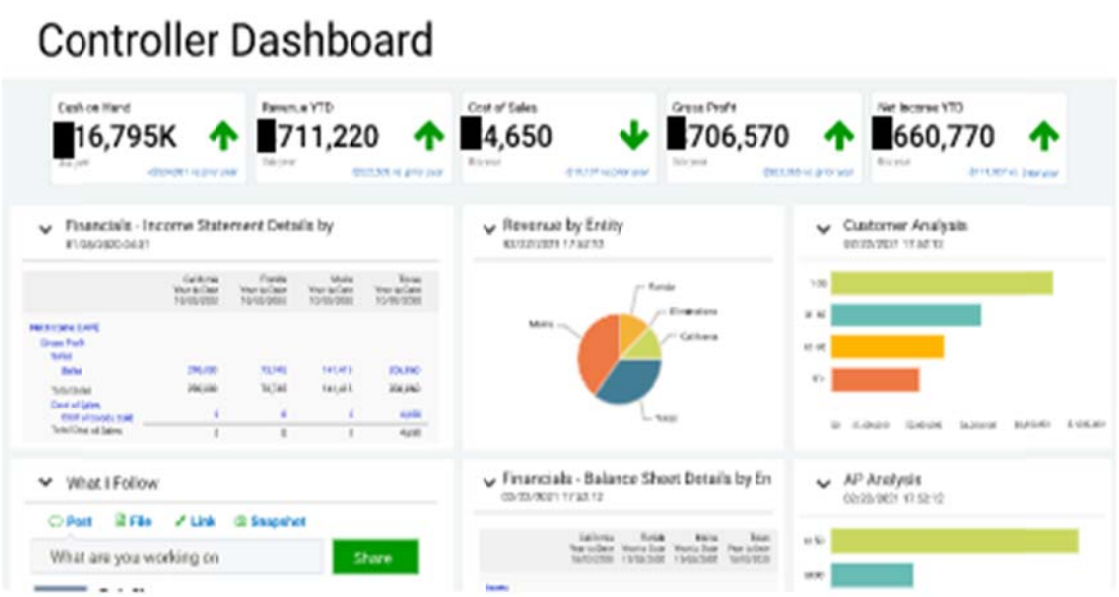

Figure 27: Grant management module – Administrator's dashboard

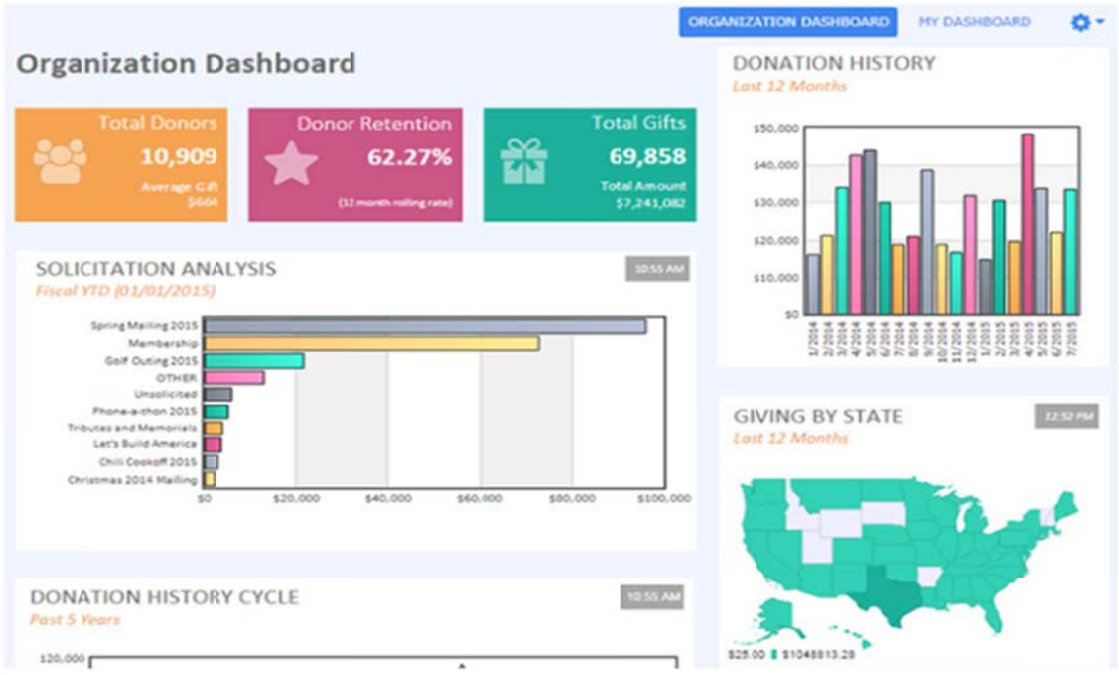

Figure 28: Fundraising dashboard

4. Conclusion

Development of a progressive Web Apps for charitable organizations is presented. The detail of the design and implementation of the web app are presented with relevant flow diagrams, use case diagrams and functional decomposition diagrams. The key mechanisms developed in this study are: grant management system (GMS), fund raising system (FRS), and cooperative management system (CMS); all in one application. The complete system eliminates high cost of hosting the individual application separately, switching application to access its services, development and management time, and usage simplicity. In addition, a uniform software interface was achieved, making it possible for donors and beneficiaries to work

with different charitable organization who adopts this application.

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