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Cloud-Based Platform for Student Developers (Case Study: Computer Science, FUTA)

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Abstract

Cloud computing is a paradigm that offers massive and scalable use of computational resources at a metered cost hereby reducing overhead. Computing resources are being delivered as a service for effective utilization for a fraction of the cost and Platform-as-a-Service is one of the services provided by the Cloud that enable developers build applications which are specifically meant to run in the cloud on a pay-as-you go service. The number of developers using existing cloud platform for storing, and building their applications are increasing exponentially. In the last few years, there have been many challenges in using this existing platform in terms of their services one of which is programming language dependency. The support offered is just for a particular programming and data model that is specifically designed for developing cloud based applications. The purpose of this research is to develop an effective cloud based platform that can be used by the developers and programmers of Computer Science Department, Federal University of Technology, Akure to host their applications in the Cloud irrespective of the programming languages they might use by enabling universal access to codes. The entire work was implemented using Bootsrap, Html, Css for the Front End and Laravel (Powerful PHP framework) and MySQL was used for the Back End. The System was able to run and scale deployed applications by the students.

Keywords

Cloud Computing, Platform-as-a-Service, Developers, Applications, Programming Languages

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1. Introduction

Cloud computing is an internet-based technology that enables convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal provider intervention [1]. Cloud computing which was once a hazy concept has now become an emerging technology that has attracted the interest of organizations, industrialists and even academics. The outrageous cost of power in terms of electricity generation, personnel hardware and limited spaces in data centers have encouraged a significant number of enterprises to move their infrastructures into a third party provider known as the Cloud [5].

Cloud Computing facilities have been used in various forms over the years either through the email, browsing on the web and also as a form of service provisioning. This has birthed some related concepts, like the mesh computing, Cloud platforms, fog computing and so on. This concept is a collection of integrated and networked hardware, software and Internet infrastructure (called a platform) which provides unlimited storage capacity, enables universe access to document, computing power and also offers dynamic, scalable, shared and elastic resources over the internet from remote data centers to the users [4]. Cloud computing is an important trend that offers three broad categories of service models which are offered on-demand over the network on a

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pay-as-you-go basis. Software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) are the three main models on which all other models are built [2].

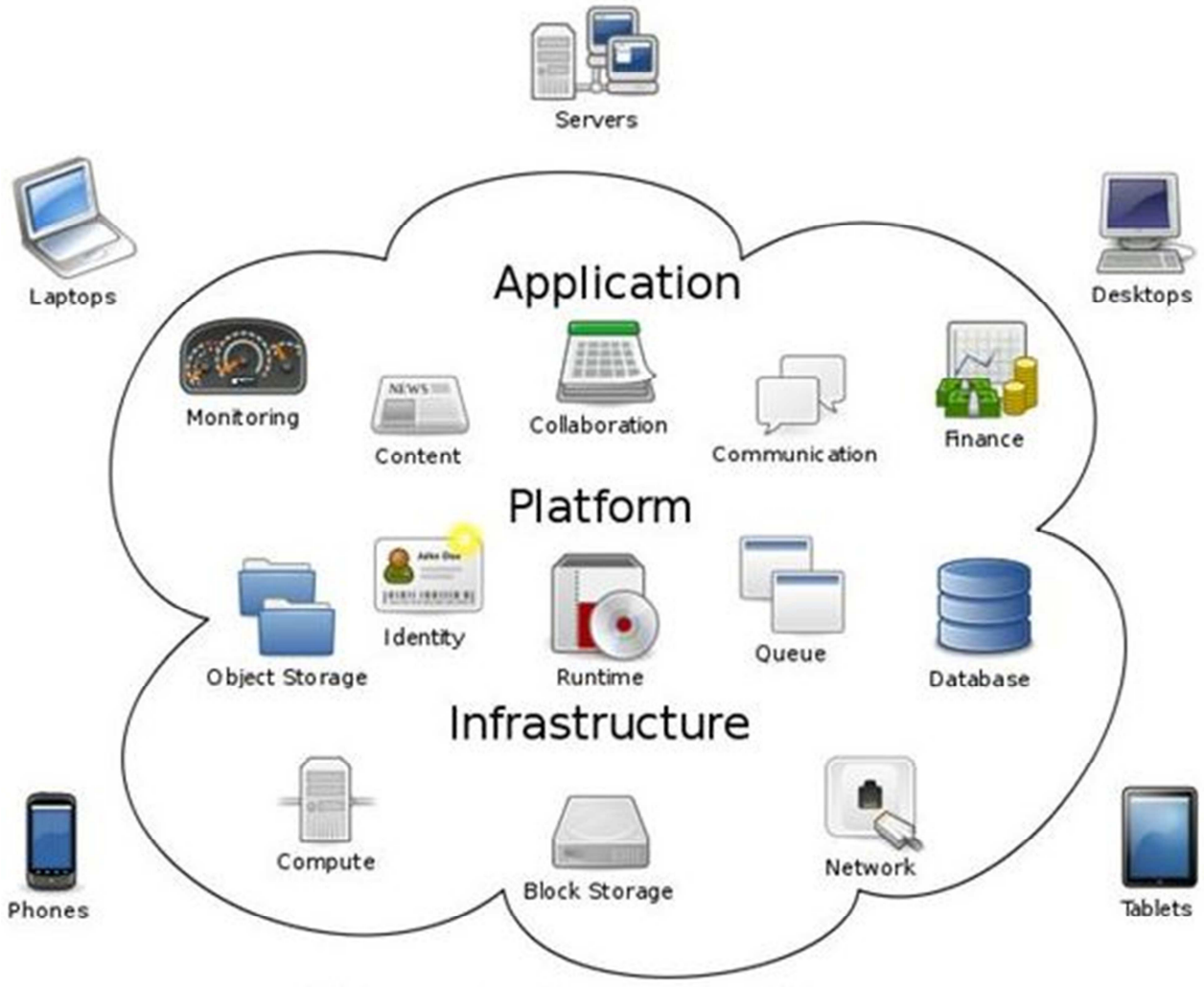

Figure 1. Cloud Architecture [10].

Figure 1 above depicted the three main models of the Cloud services and their relationship. The Platform as a service (PaaS) is the capability provisioned to the cloud user to deploy acquired infrastructures and created applications to the Cloud using programming languages and tools supported by the Cloud provider. The underlying cloud infrastructure which comprises of the network, servers, operating systems, or storage has no need to be controlled by the consumer, but only over the deployed application and possibly application hosting environment and its configurations. Google App Engine, Microsoft Azure, Heroku and Amazon Web Service are one of the most famous PaaS providers available [9].

CHARACTERISTICS OF PLATFORM-AS-A-SERVICE (PAAS)

Some of the major characteristics of PaaS include:

I. Support for custom applications.

II. Provision of runtime environments.

III. Rapid deployment mechanisms.

IV. Support for a range of middleware capabilities

V. Provision of services. [8]

2. Related Works

There had been various works done on the emerging paradigm Cloud Computing and work is still ongoing. Related works is being looked into to determine what had been done so far and what still needs to be done.

The Aneka cloud platform is a structure for developing distributed applications and also provides developers with a rich set of APIs for transparently exploiting several resources by expressing the application logic with series of programming abstractions. The work was motivated to provide resource facilities in a seamless and dynamic

fashion. The computing resources of a heterogeneous network of workstations and servers were harnessed on demand in such a way that the system administrators can leverage a collection of tools for monitoring and controlling of the deployed infrastructure. However, The work was unable to showcase a cloud usage scenario on its web page due to lack of public PaaS, it rather publishes its usage on batch oriented parallel computing which is a workload that emulates grid computing. The aneka cloud platform does not use vast resource provisioning framework but has support for VMWare, Eucalyptus, and Inter-Grid [9].

A research was carried out on the framework of a PaaS offering. It was surmised that developers could run a fairly complex Java based application in a distributed web environment, with no specific change to the code using a particular developed PaaS. A new PaaS, that is proficient in supporting several cloud implementations through which the developers will not be able to be lock down into a specific SDK was developed. This work displayed a good relationship when the number of nodes were increased, this permits the developer to presents a good scalability solution to the PaaS offering. However, infrastructure management encumberance from the end user and the restriction usage of the processing node's local resources were not removed. The metrics gathered from the servers through the Simple network management protocol generated ripples concerning the MySQL server resource consumption [3].

The work of Fruhjahrstreffen focused on COSCA, which is a PaaS system that allows applications to be composed from components. These can be individually updated and deployed similar to bundles in OSGi. COSCA further supports sockets for arbitrary communication. It also addresses the replication mechanisms of the Cloud and how they can be connected to COSCA. The work was able to present multiple building blocks for fault-tolerant applications that were developed within COSCA's predecessor projects and are ready to be integrated [4].

The work of Karan researched and identified the challenges of cloud computing and also highlighted the cloud interoperability issue that deserves substantial further research and development. However, security and privacy issues present a strong difficulty for users to adapt into the cloud computing systems [7]. It was based on the above that a DevHub platform is being proposed that will enable developers in the School of Computing to have access to a free, language independent and open Cloud Platform that will enable them to develop, deply and scale their applications and also afford easy access for supervisors to view students projects.

3. System Design

This proposed work is based on implementing the Platform-as-a-Service (PaaS) application of the Cloud that enable developers to upload, scale, build and run their project and also serve as a platform whereby the developer's project supervisors have the opportunity to check, view the scaled apps of their students on the platform without them having the need for the supported resources as far as they have full internet connection. The entire work was implemented using Bootsrap, Html, Css for the Front End and Laravel (Powerful PHP framework) and MySQL was used for the Back End.

The proposed system is a three-tiered architecture which involve the following

I. The front end (Client).

II. The application Server.

III. The back end (Data store).

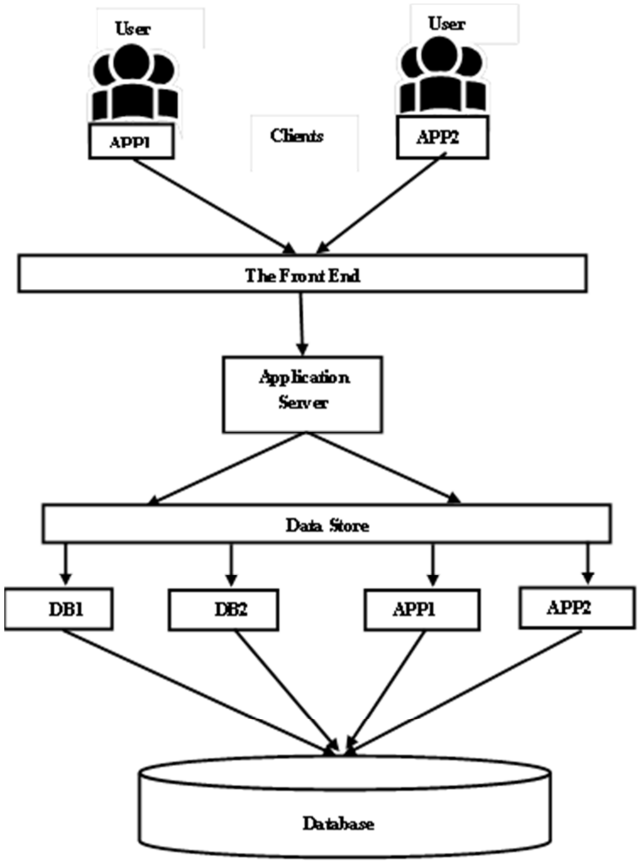

Figure 2. The architecture of the proposed system.

The front end includes the client's computer and the application required to access the Cloud. The front end is the side visible to the client. The application Server which is a software framework that provides both facilities to create web applications and a server environment to run them acts as a set of components accessible to the software developer

through a standard API (Application Programming Interface) defined for the platform itself. The Backend is the data store where various computers, servers and data storage systems that create the "cloud" of computing services are stored. A back end database is accessed by users indirectly through an external application rather than by application programming stored within the database itself or by low level manipulation of the data (e.g. through SQL commands).

3.1. Use Case Diagrams

The use case diagram below illustrates the general overview of the proposed system by showcasing all the actions expected to be performed by the users and the admin.

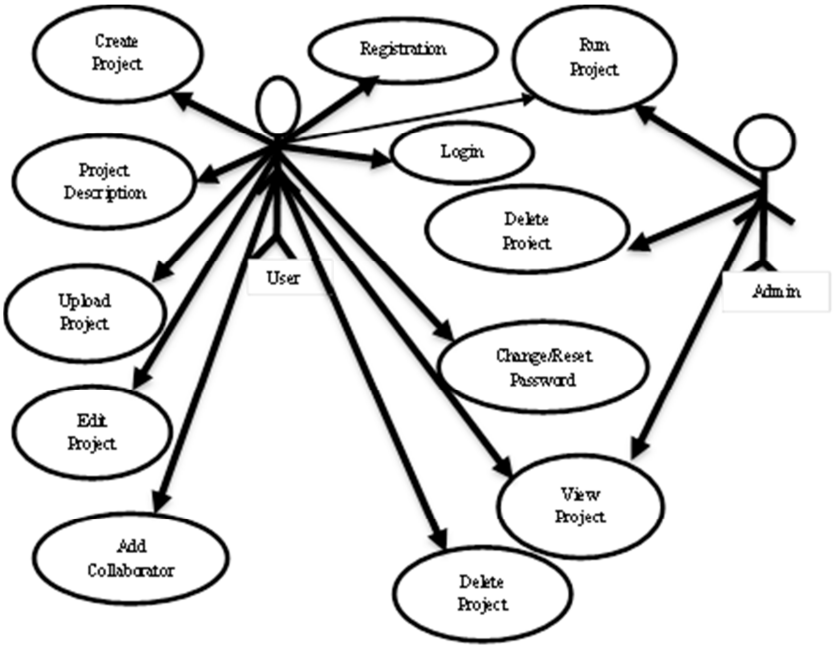

Figure 3. The application use case diagram.

3.2. The System Flowchart

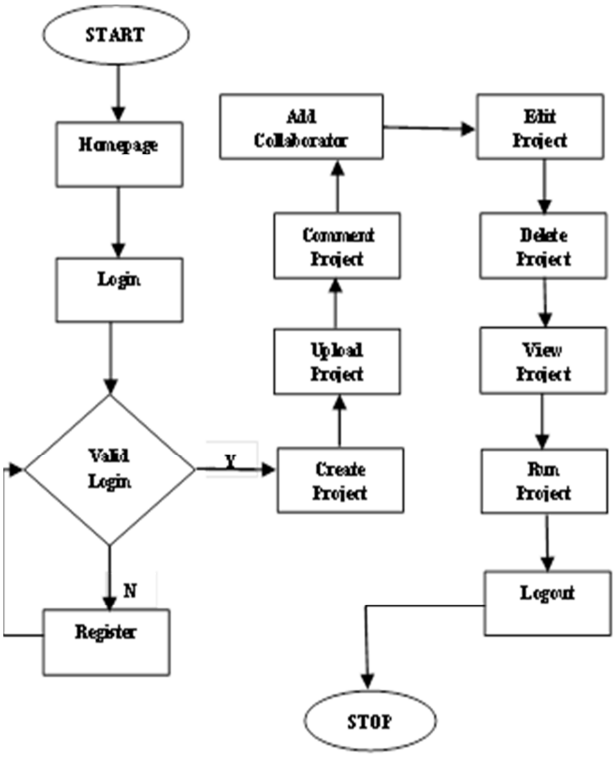

Figure 4. The Flowchart.

The system is designed in various modules with various buttons and links for navigating through the entire system.

4. Results and Discussion

This describes the implementation details of the platform created for the developers called “DevHub”.

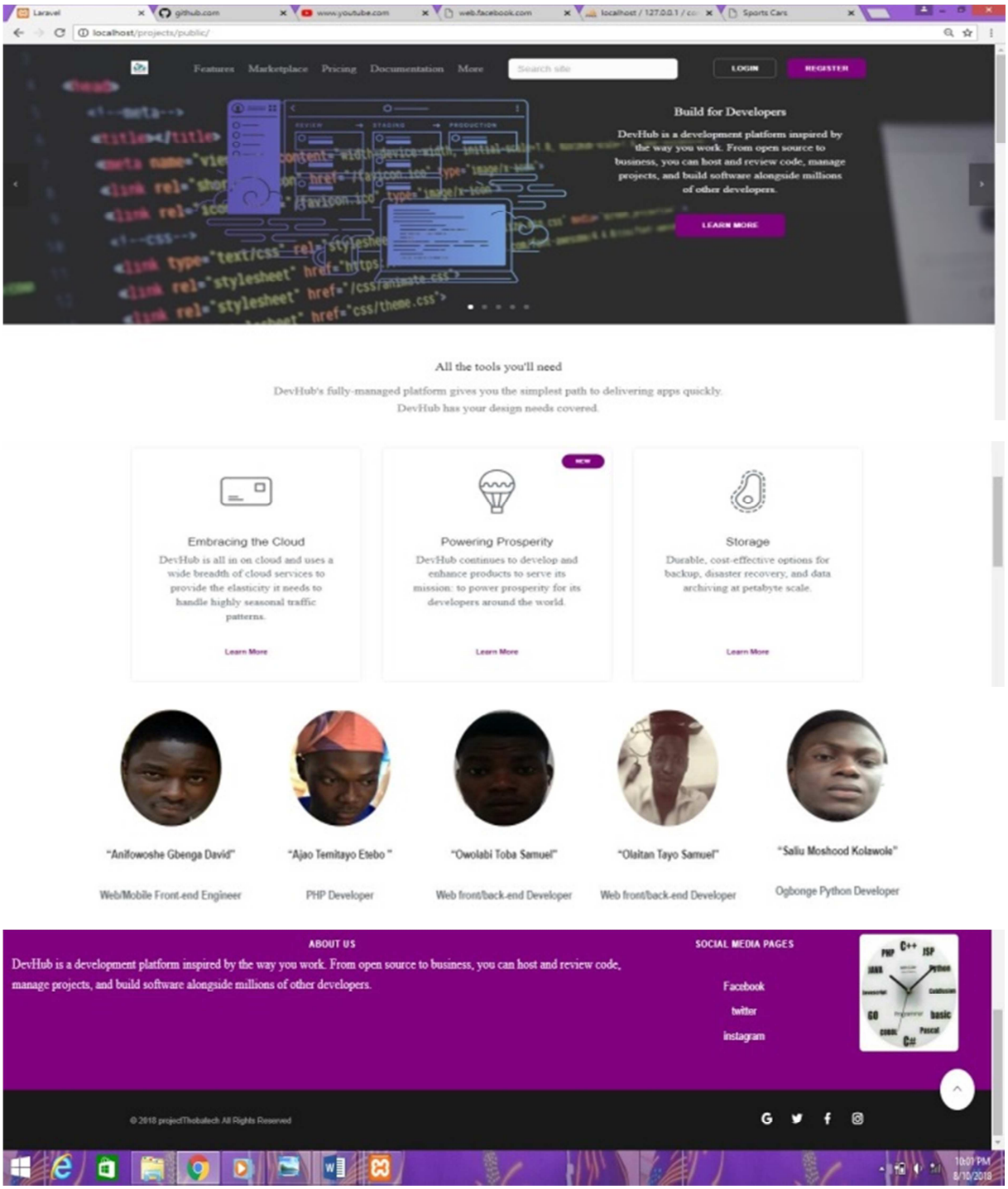

Figure 5. The Welcome /Home Page.

The welcome home page gives the general overview and the services offer by the proposed system. The platform enables users to login into their accounts, and new users to register with the system. Registration involves users submitting details that include Name, Email and Password.Registration cannot be completed if any of the required field is missing.

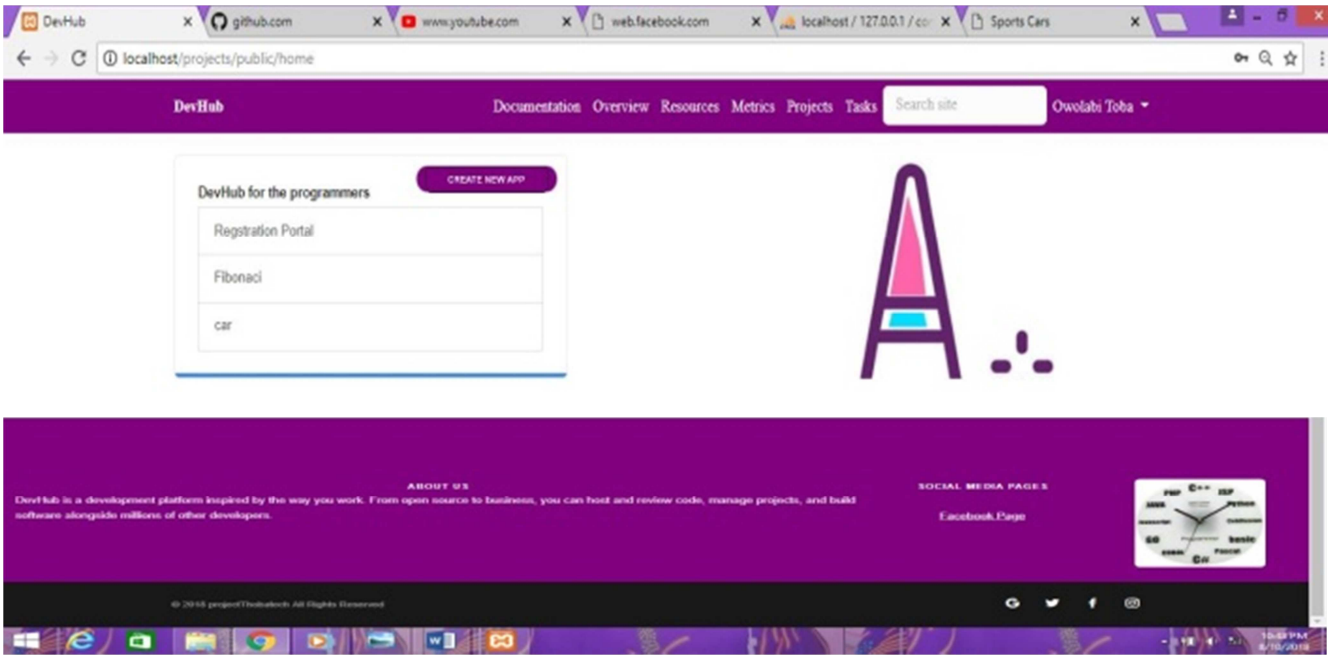

Figure 6. The Project Page.

The project page basically displayed all the projects created by the login (valid) users. The page can contain as many projects that is created by the users.

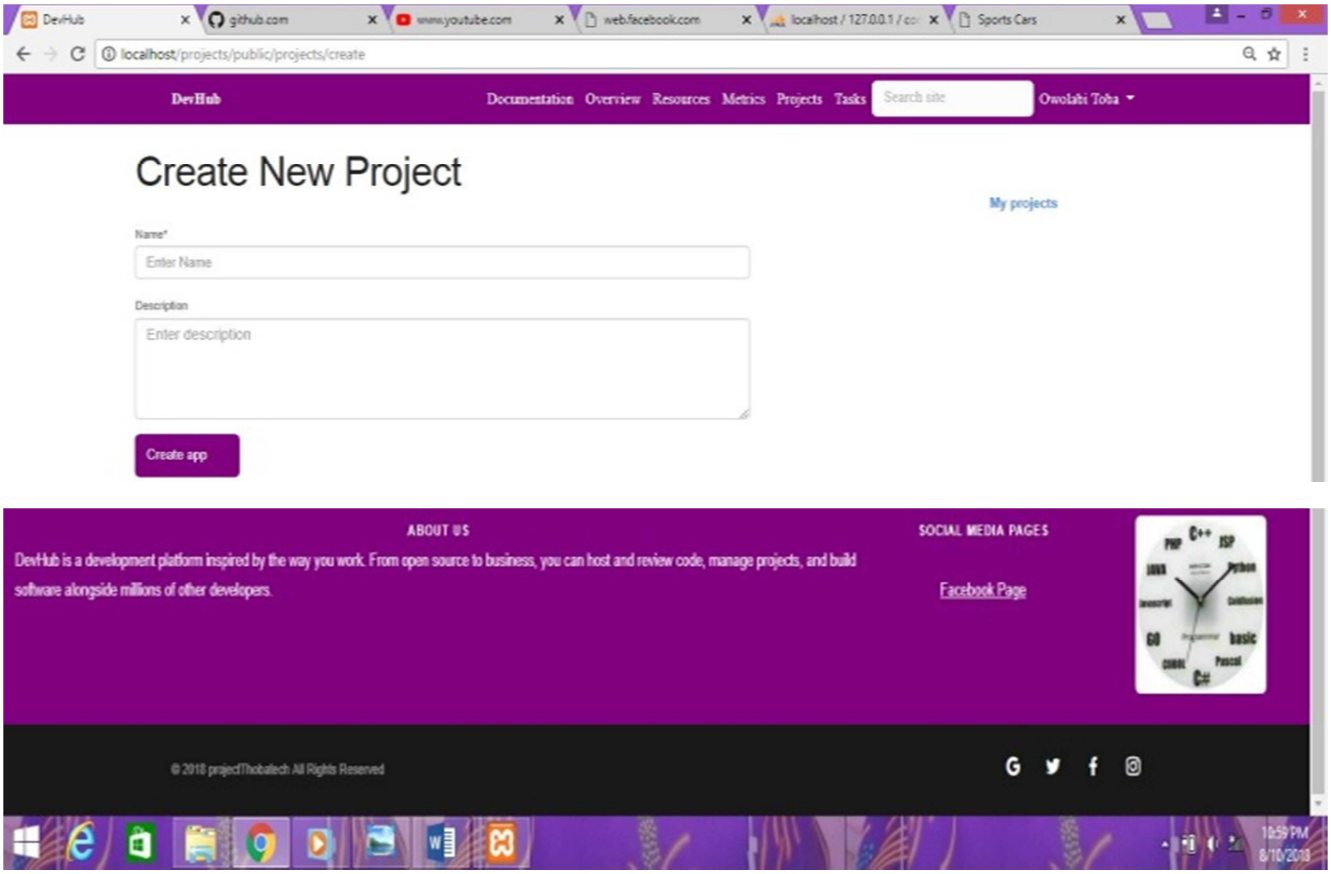

Figure 7. Create Project Page.

This is the page where the use can create a project by supplying the project name i.e. the name they want give to the project along with the brief description about the project.

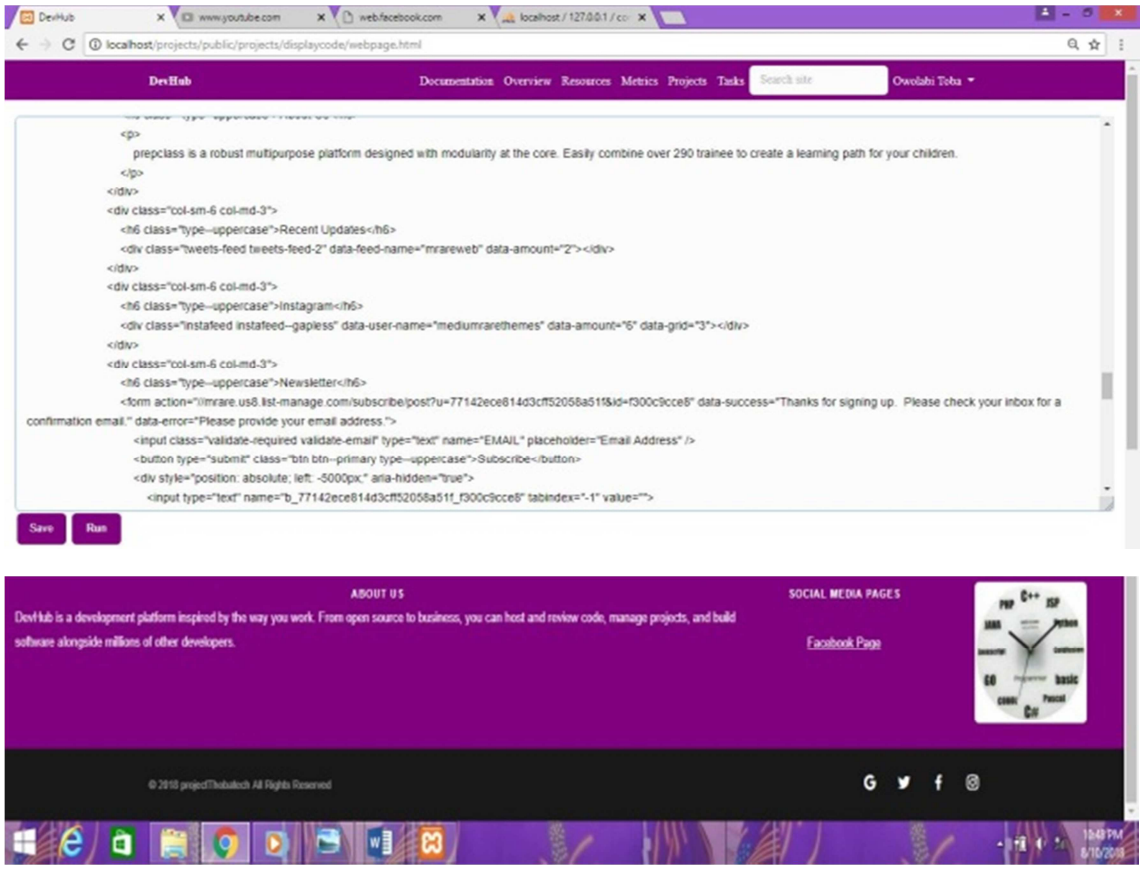

Figure 8. The Display Code Page.

This displays the raw content of the project uploaded by each users inside a container where they can modify their code and click on run button to display the result of the uploaded project.

Figure 9. Simple CGPA Calculator.

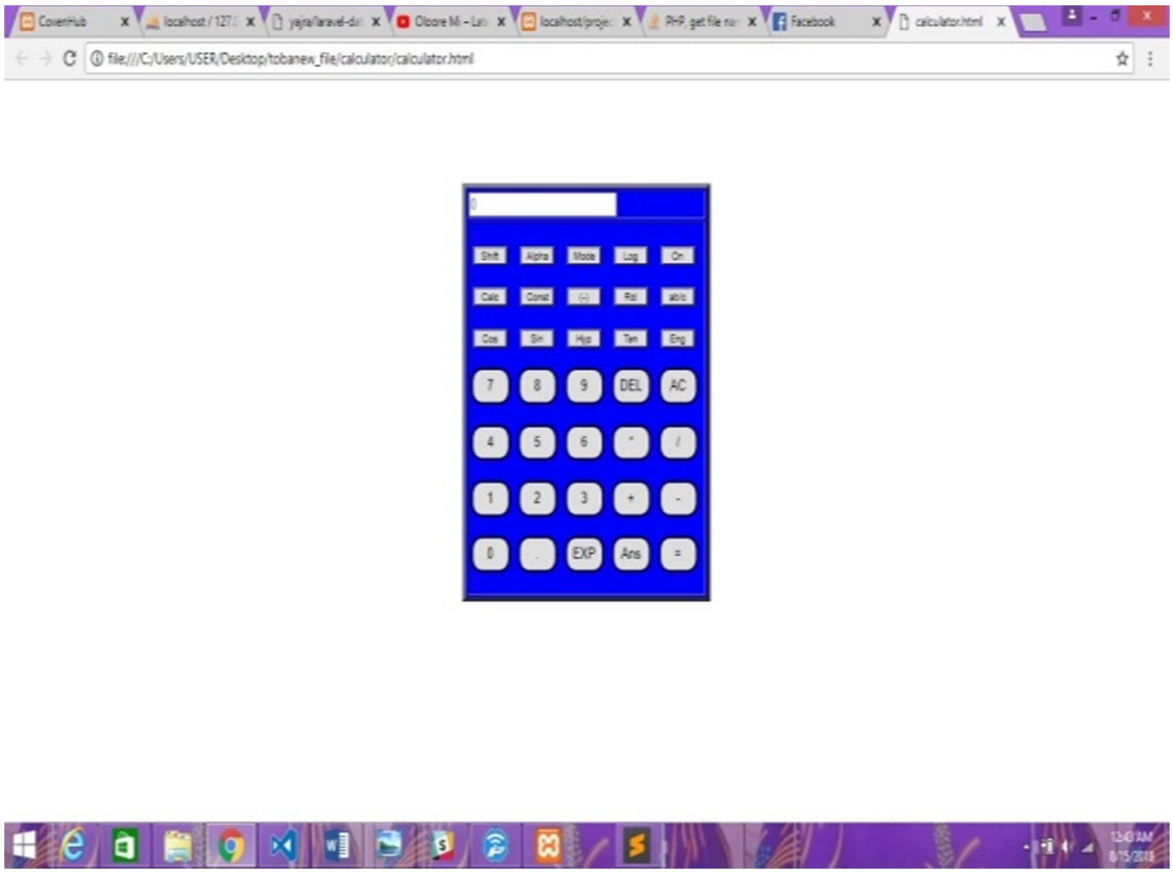

Figure 10. The Simple Scientific Calculator.

This is a simple scientific calculator application that was deployed on the platform.

5. Conclusions

The work was able to successfully run JavaScript based applications in a distributed web environment, with no specific code change using our developed PaaS. The platform developed provides a cutting edge innovation for developers to manage and build their projects. It does not require users to purchase expensive software or to spend money on installing hardware and providing system infrastructures; users only push their codes on the platform and hover on the run button to see the output. The major source of limitation of this system is the inability to run many programing language on the platform, the platform only support JavaScript Programming Language but it can serve as a storage for many other programming languages

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