Nigeria Educational System and Emerging Web Technologies: The role of Progressive Web Applications, Challenges and Applications

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The Nigerian educational system is undergoing a transformation driven by emerging web technologies, with a particular focus on Progressive Web Applications (PWAs). This paper explores the role of PWAs in enhancing the educational experience, the challenges faced in their implementation, and their applications within the Nigerian context. PWAs are a type of web application that combines the best features of both traditional web pages and mobile applications, offering users a seamless, fast, and engaging experience. In the Nigerian educational landscape, PWAs have the potential to bridge the digital divide by providing access to educational resources and tools to a wider audience, regardless of their geographical location or device capabilities. However, challenges includes limited internet connectivity, infrastructure constraints, and varying device capabilities present obstacles that need to be addressed to ensure widespread adoption and usability. Additionally, issues of data privacy and security must be carefully considered to protect sensitive educational information. Despite these challenges, PWAs offer numerous applications in the Nigerian educational system. PWAs enables offline access to educational materials, allowing students and teachers to continue learning even in areas with intermittent internet connectivity. Furthermore, PWAs can foster communication and engagement between students, educators, and parents, promoting a collaborative learning environment. This paper investigates the potential of PWAs to revolutionize the Nigerian educational system, addressing the challenges they face and highlighting their diverse applications. By embracing these emerging web technologies, Nigeria can enhance access to quality education, promote digital literacy, and empower learners and educators with innovative tools and resources.

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Introduction

Today's cutting-edge innovation may play a critical role in smoothing out training-related cycles to improve fortitude among students, instructors, parents, and school employees. The importance of instruction in the improvement process cannot be overstated. It is one of the most effective tools for reducing poverty and imbalance, as well as laying the framework for supported monetary development. According to Bjorn-Hansen et.al 2017, administration that places a strong emphasis on the educational field, and school improvement activities such as continuous professional development for instructors, preparing and overhauling educators, and equipping schools with labor supply and materials are among the major moves that have been made in both essential and auxiliary schools, even at the tertiary levels usually thrives in the future. One of the most important instruments for working with and on these tasks is to have an automated school management system. Fast technological alterations are influencing how goods and administrations are planned all the time. The turn of events rehearses for apps have been developed since the introduction of cell phones (Paltoglou et.al, 2018). Because engineers must write, test, and maintain programs for each of the numerous phases and devices, traditional portable application development has been described as a time-consuming and costly process. As a result, most adaptable programming engineers are employing a variety of strategies to improve the progression of applications from local to half-breed programs. Furthermore, a few ways for cross-stage development have been given out as an optional path for long-term local progress.

The portable web is based on a web application that is typically cross-platform. This type of software adheres to industry-standard languages like HTML5, CSS3, and JavaScript, which provide full app portability between platforms like Android and Apple Progressive Web Apps (PWA) is another web innovation pushed by Google as a unique approach to create, as they promise to combine web innovations' simplicity of advancement with the adaptability of local applications and bits of knowledge to overcome the constraints of portable web applications by trying to present elements such as unconnected help (offline support), pop-up message, background synchronization, and home-screen establishment to the web. Furthermore, PWA has been updated with a few enhancements that take into consideration localized behaviors in a mobile phone while still operating in a web application. However, because of the intrigue, logical inclusion of PWA as a cross-stage improvement strategy was less certain. As a result, until now, PWA has mostly been evaluated in the Android domain, as well as in the current area

Site pages today are more than just static HTML markup. We've progressed from a Web without JavaScript, where all connections should have been handled by the server, to using JavaScript just for activities and minor convenience features, to developing entire applications in JavaScript that mostly communicate with servers behind the scenes. When JavaScript gained the ability to execute HTTP requests and retrieve or save data in the foundation, a technology known as AJAX at the time, it was only used for minor purposes. Single Page Applications (SPAs) were

developed later, with the application being layered once at the start and then transmitted in JSON or XML later (Fransson and Driaguine 2017). This presented additional hurdles to JavaScript developers, such as delivering layouts in a timely manner. This presented new hurdles to JavaScript developers, such as supplying layouts in the program, monitoring application state, and steering (the planning between application state and the URL showed in the location bar of a program). In addition to Web development, cell phones and associated applications, often known as local applications nowadays, were developed (instead of web applications). These programs used the full capabilities of the devices they were running on and could accomplish a lot more than a web application in the beginning. This meant that a company that wanted to reach as many customers as possible had to produce many versions of the same app: for the web, the workplace, and a few other platforms. Later efforts like Cordova and Electron made it possible to use JavaScript and other web developments in programs as well as local mobile and desktop applications, but the goal of making the web the most widely used application platform remained.

Optimizing for smart phones initially and gradually transitioning to larger devices is known as the "mobile-first" method for designing and marketing. It serves as a reaction to the expanding need for better mobile experiences. A major factor in the rise of mobile-first technology was Google's announcement at the 2010 Mobile World Congress that they would be adopting the strategy and urged other designers to follow suit. A replacement for graceful decline is progressive enhancement. It differs from the earlier method in that it places more emphasis upon that content (Shah, 2014). Any device or internet service can view the basic information and features on a web page, while people who have more sophisticated technologies or bandwidth efficiency can access an improved version of the website

Problem Statement

Due to the inefficiency of the current manual system, it is necessary to automate SMS in order to efficiently handle students' attendance, produce transcripts, report cards, and other reports that satisfy users and customers, and create a timetable that can schedule courses for teachers and classes of students

Methodology

3.1 Research design react.js

“React is a JavaScript library, used for building UI. Facebook first introduced React in the year 2013. It was made open source two years later. React uses the virtual DOM for manipulating the UI as a result it gives blazing fast performance and making site most interactive as shown in figure 7”.

Figure 1 Rendering with the Virtual DOM in React.

As illustrated in figure 1, React keeps good track of an in-memory Virtual DOM. Facebook developed React specifically to solve one problem: building large application with data that changes over time. Thus, React adopted the declarative, Component-Based, Learn Once and Write Anywhere strategy. React makes it seamlessly easy to create interactive UIs. Designing simple views for each state in application, React smoothly updates and renders just the needed components when the data changes. Declarative views in React make code easy to predict and debug.

React uses component-based structure. Component logic are written in JavaScript instead of templates which makes the easy passage of rich data through the web app and keeping state out of the DOM. Problems are solved by creating reusable components and when components get complex, they are broken down into smaller and simpler ones. React components are similar to JavaScript function

As previously explained, the application uses push notifications to re-engage the user with the application even when the application is closed. It enhances user real-time interactions and provides a native application experience. React is also used in the server side using NodeJs and power mobile apps using React Native. All these features collectively make React the most loved one among the developers compared to other frameworks and libraries. It has outdone its competitors AngularJs, Angular 2 and Ember within three years of its release as seen in Figure 8. Now, React is taken as a paradigm in the world of front-end web development.

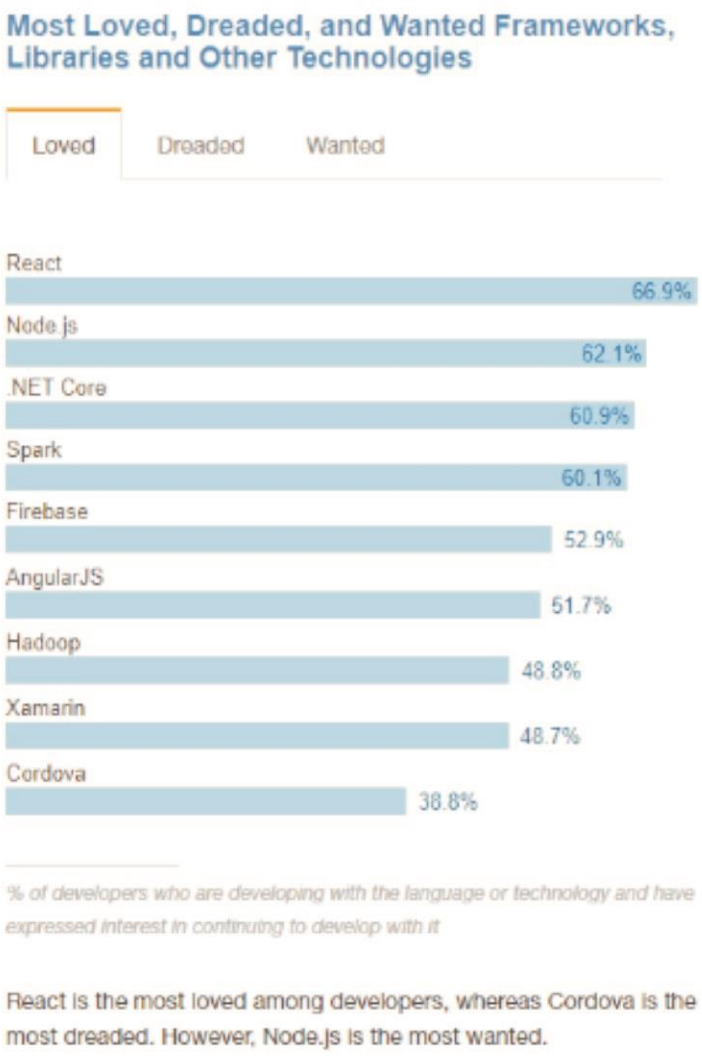


Figure 2. Most loved technologies of 2017 in web development

As shown in Figure 2, React was the most loved technology in 2017 at 66.9% whereas the least loved one is Cordova with 38.8% only. React uses an XML-like syntax JSX, a syntax extension to the ECMAScript to describe the component's DOM representation. It looks similar to that of the mark-up language HTML or XML but it is JavaScript centric. It makes code more readable and writing JSX gives the feel of writing HTML. It is based on separation of concerns rather than technology as it combines mark-up, style and behaviour of components in one file rather than having each separate files. However, it is not compulsory to use JSX in React application but the use of JSX helps for easy development, error handling and increase performance of React application.

3.2.1 Creating the React App

Create react app is a tool to get started with React.js app development. Create react app with preconfigured Webpack, Bable and other necessary tools makes an app development process smooth, and hassle free. It also comes pre-configured with Service Worker, which is one of the key components of PWA. Create react app can be easily installed from the terminal with the command: npm install -g create-react-app, as shown in Figure 1.

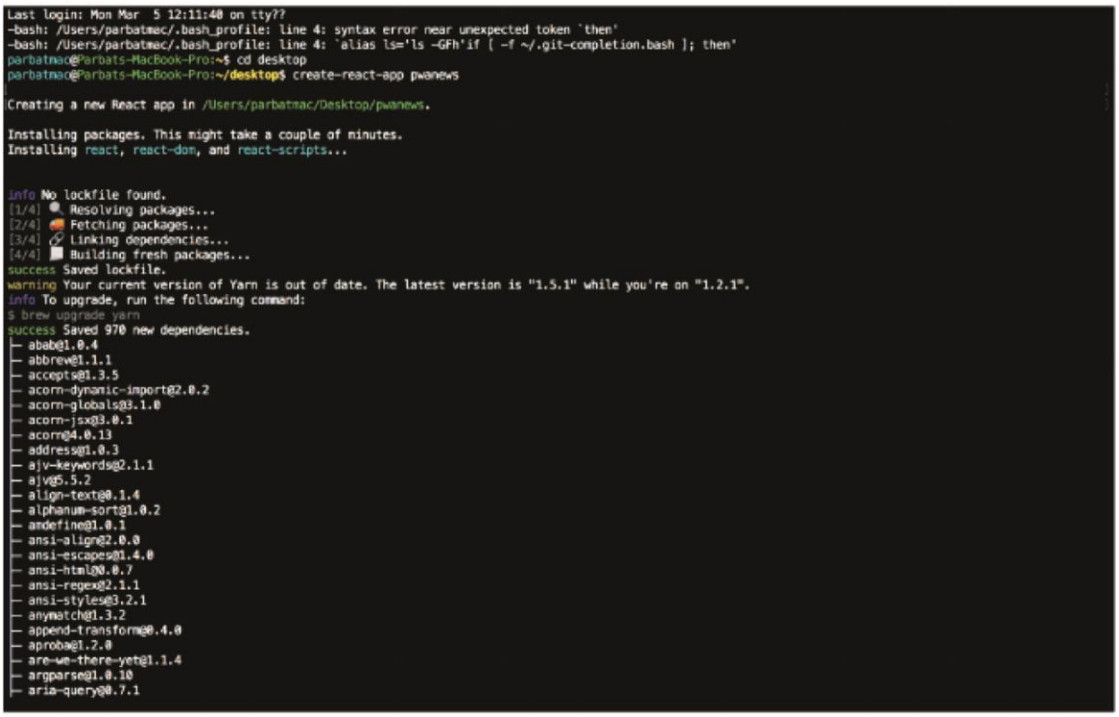


Figure 3. Installing create-react-app project

As illustrated in figure 3, create-react-app pwanews creates a new React app in ~/pwanews. Changing directory to pwanews and running npm start runs react script starting the development server.

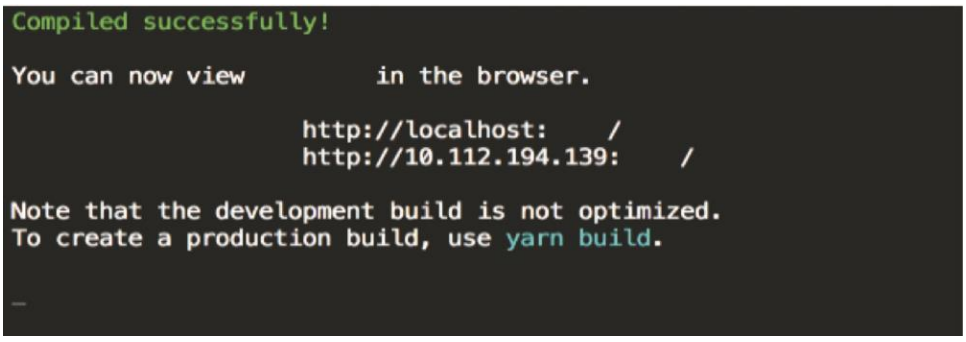


Figure 4 Create-react-app compiled successfully

As shown in figure 3, after the successful compilation of create-react-app, it can be viewed in the browser by visiting http://localhost:3000.

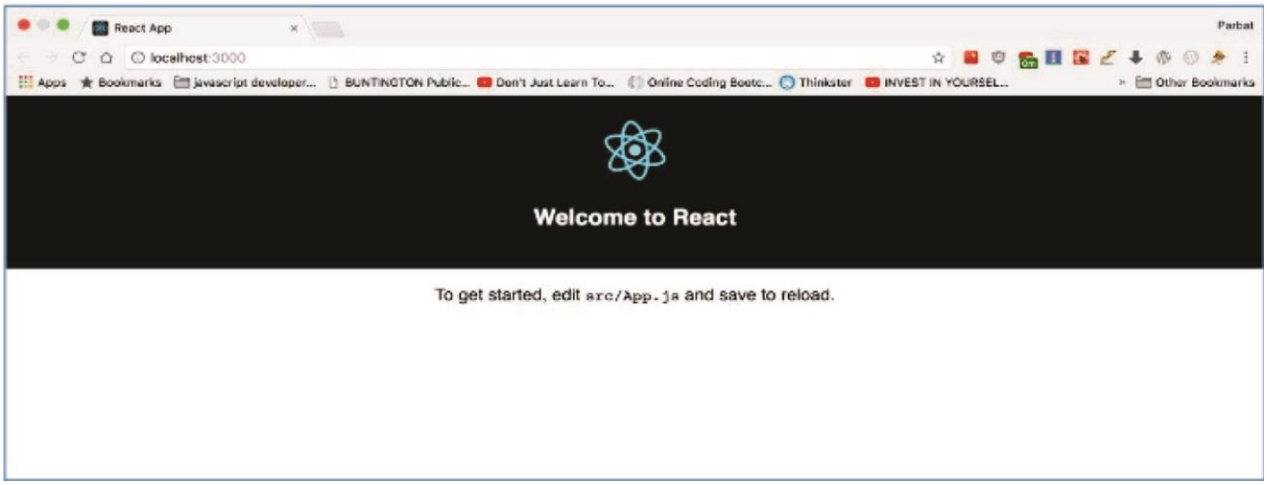


Figure 5 Default create-react-app project in local host

3.2.2 Web Pack

Webpack is a static module bundler for modern JavaScript applications. Modern JavaScript applications have various modules and stylesheets. These modules and stylesheets make the development process easy. However, during the time of deployment it creates hassle. When webpack is used, it processes the app and recursively builds a dependency graph, which includes every module needed by the application and packs all those modules into one or more bundles. Webpack improves the performance of the application.

3.2.3 Babel

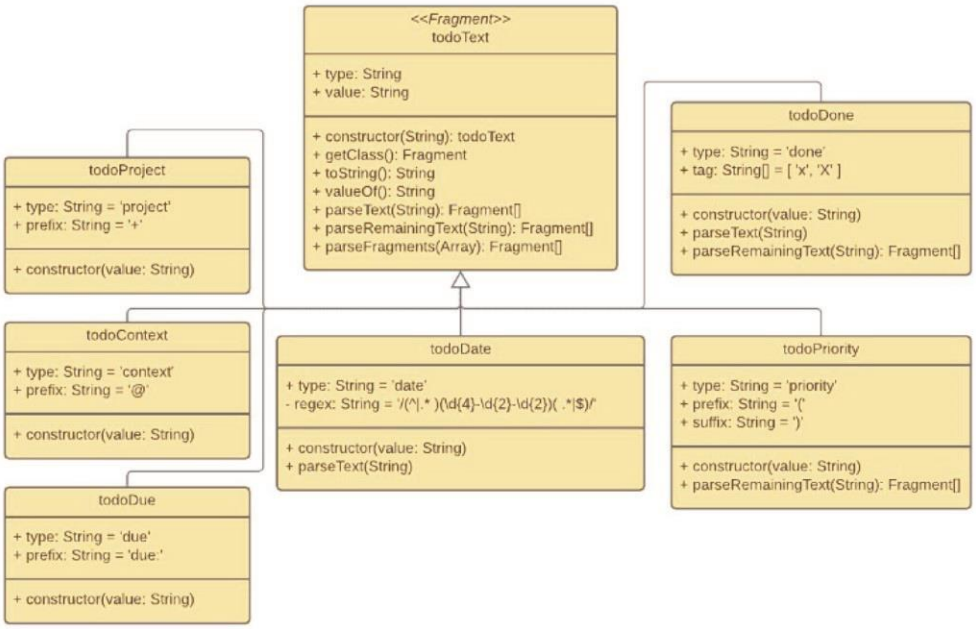
Babel is a JavaScript compiler. It transforms the new version of JavaScript code to the older version. In conjunction with Webpack, Babel trans piles ES6 and JSX to ES5. It is done to support the maximum number of users possible.

3.2.4 Serializing todo.txt into JSON

Representing data as attributes with values for use in communication or storage can be done by using several different standardized formats. Common formats are ?Extensible Markup Language (XML) and the open and in comparison somewhat relaxed standard ?JavaScript Object Notation (JSON) (?ECMA, 2017)?. Not exclusively used by JavaScript (although the syntax resembles JavaScript and is the origin of its name), JSON is considered the standard format for web applications ?(Rischpater, 2015, Chapter 1)?.

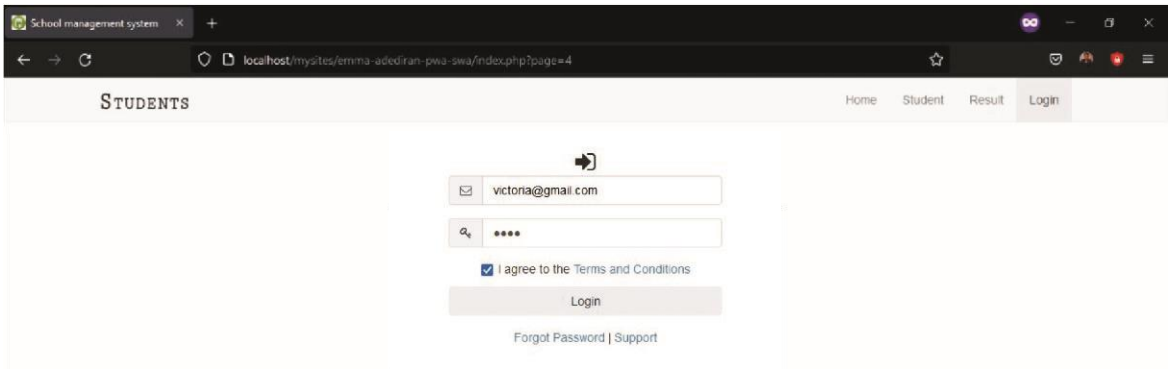
Using a modular design implies components or parts that need to communicate data between the graphical JavaScript frontend, the data model and the server PHP backend. Using JSON as a standardised format for representing data makes this a standardized procedure.

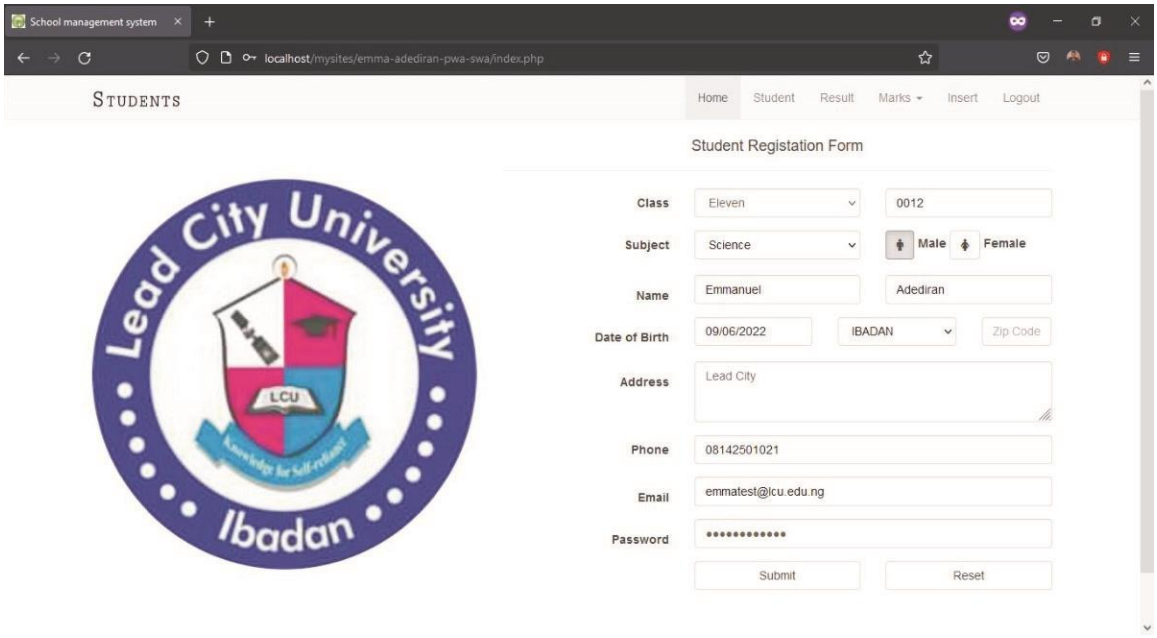
3.3 Class Diagram



After development and testing of the library yielded a usable result ?Roll up was used to create several JavaScript bundles compatible with multiple targets (E?SM, ?Common JS and ?Universal Module Definition ? formats). The bundles were then compressed into a distributable archive.

Results




School management system
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STUDENTS
Home
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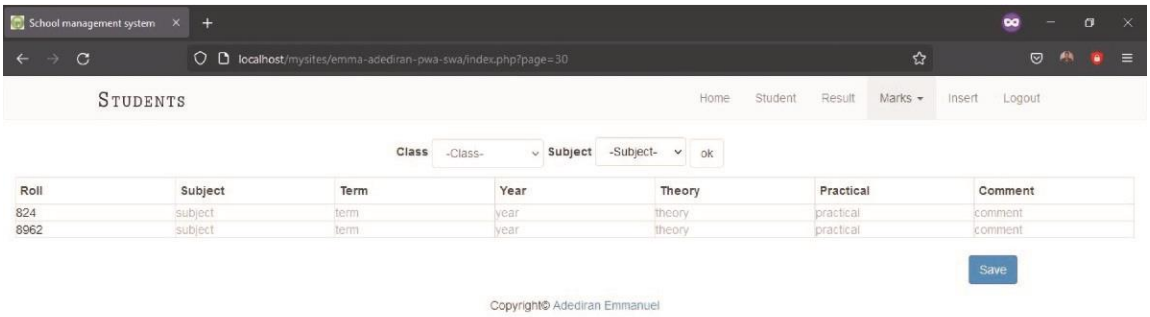
School management system
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STUDENTS
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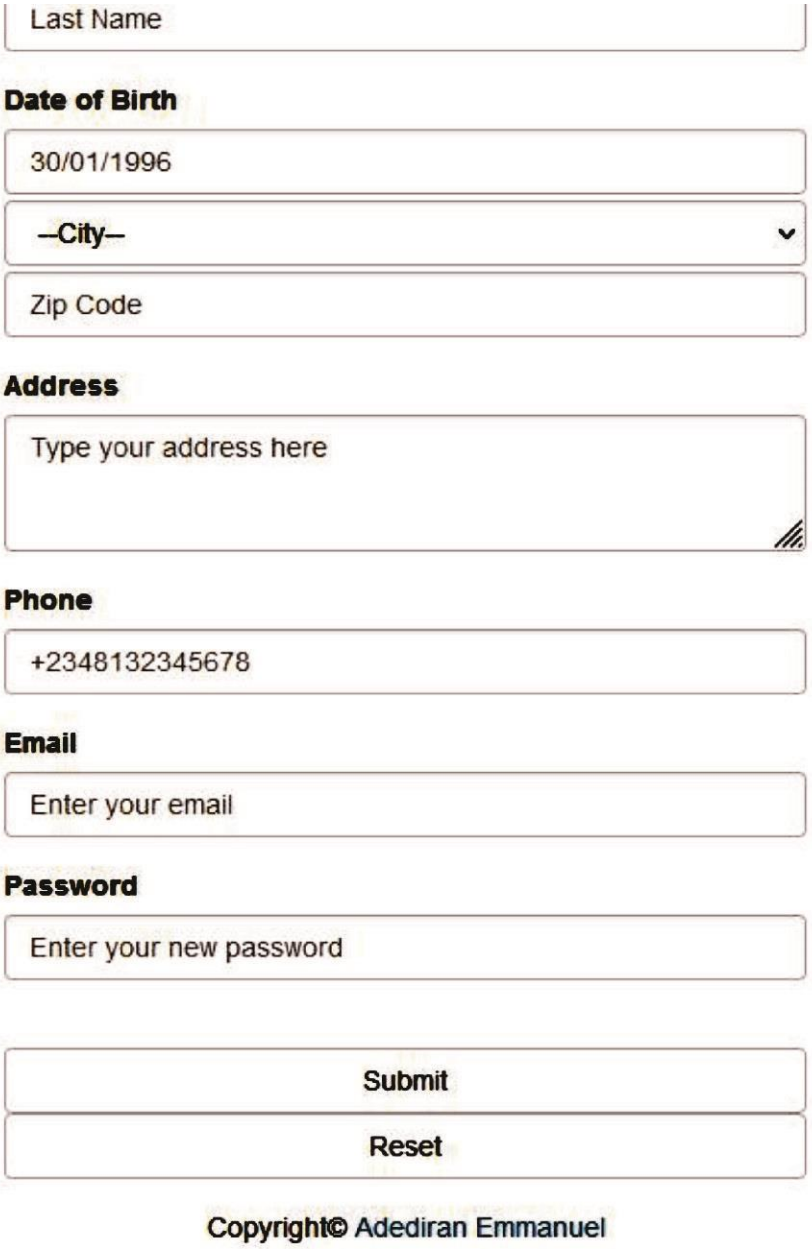

Summary

By providing teachers with a convenient location to find and categorize details, student management solutions enable faculty members' jobs. Instructors and college administrators can monitor their students' participation thanks to this technology. This innovation is of immense help to the school, faculty, department which embodies members of the academic staff and students.

Conclusion

In conclusion, Instructive organizations can basically keep their understudy records by utilizing understudy the board frameworks. The manual framework makes it hard to achieve this objective on the grounds that the data is scattered, frequently excess, and social event relevant information

could take a ton of time. This undertaking settle every one of these issues. This framework supports safeguarding the association's understudy data set. The supervisor may promptly get to it and keep it secure for quite a while without making any changes.

Contribution to Knowledge

·Bridging Educational Gaps: Nigeria's educational system faces disparities in access and quality of education between urban and rural areas. PWAs can bridge this gap by providing a consistent, web-based learning platform that is accessible to students across diverse geographical locations. This approach can contribute to more equitable educational opportunities.

·Digital Literacy Research: The adoption of PWAs in Nigeria's educational system can become a focal point for researching digital literacy levels among students and educators. Studies can be conducted to understand how well students adapt to using web-based applications, identify challenges they face, and propose strategies to enhance digital literacy skills.

·Pedagogical Innovation: The integration of PWAs can prompt educators to rethink their teaching methodologies. Research can explore how PWAs facilitate interactive and personalized learning experiences. Additionally, investigations into the most effective ways to design and deliver educational content through PWAs can lead to new pedagogical approaches.

·User Experience (UX) Design for Education: Developing PWAs for education requires a deep understanding of user experience. Research in this area can focus on designing intuitive interfaces, optimizing content delivery, and ensuring a seamless experience for students and teachers. This can contribute to the broader field of UX design in educational technology.

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